

PSYCHOLOGY FOR TEACHERS

BY

CHARLES E. BENSON, PH.D.

*Professor of Education and Chairman of Department of Educational
Psychology, School of Education, New York University*

JAMES E. LOUGH, PH.D.

*Formerly Professor of Experimental Psychology and Method
New York University, Dean of Harriette Melissa
Mills Training School*

CHARLES E. SKINNER, PH.D.

Professor of Education, School of Education, New York University

PAUL V. WEST, PH.D.

Professor of Education, School of Education, New York University

REVISED EDITION



GINN AND COMPANY

BOSTON • NEW YORK • CHICAGO • LONDON
ATLANTA • DALLAS • COLUMBUS • SAN FRANCISCO

COPYRIGHT, 1932, BY GINN AND COMPANY

ALL RIGHTS RESERVED

PRINTED IN THE UNITED STATES OF AMERICA

833.4

COPYRIGHT, 1926, BY GINN AND COMPANY

The Athenaeum Press

GINN AND COMPANY • PROPRIETORS • BOSTON • U.S.A.

PREFACE

The first edition of this book was published in 1926. In the preface of that edition it was stated that the book was intended primarily for students of college grade in normal schools, teachers colleges, schools of education, and departments in universities engaged in the training of teachers. It further stated that the aim of the book was to set forth the psychology teacher's need for the specific work of teaching and of guiding the development of the mental life of growing children. This revision holds the same basic aim, although the scope is somewhat broadened. The first edition was not, and this revised edition is not, a compendium of psychological facts, nor has it been the intention of the authors to cover the entire field of psychology, but rather to present the facts of psychology that teachers can use in their daily work. In the preparation of the first edition, as well as the revised edition of the book, each of the authors has been responsible for the chapters which came within the field of his special interest; but to insure the greatest unity possible, the entire text has been carefully edited and reviewed by all.

The aim of the authors is to present a textbook which is an integration of various points of view rather than a compromise or an emphasis on any one system of psychology. During the six years since the first edition came from the press many new developments have taken place in the field of educational psychology. The authors have profited by the criticisms which have been made. They are indeed grateful to all of those who have used it as a text and for the many

suggestions for its improvement. In this revised edition several new chapters have been added; some have been expanded to meet the growing needs and demands of this particular period in our history. The authors wish to express their deep obligation to the psychologists under whom they have studied and to all who have contributed to the improvement of the textbook and the arrangement of its material. They are most grateful for the criticism and kindly interest of the thousands of students they have had in their classes during the past six years.

The authors also wish to express their sincere thanks to publishers and authors for the privilege of quoting from their publications.

C. E. B.
J. E. L.
C. E. S.
P. V. W.

CONTENTS

PART ONE • <i>The Bases of Behavior</i>		PAGE
CHAPTER		
I. INTRODUCTION: THE SUBJECT MATTER AND METHODS OF EDUCATIONAL PSYCHOLOGY . . .		3
II. ORIGINAL NATURE		16
III. NATURE AND NURTURE		36
IV. BIOLOGICAL FOUNDATIONS OF BEHAVIOR		55
V. GROWTH AND DEVELOPMENT		88
VI. THE DYNAMICS OF BEHAVIOR		102
VII. FEELINGS AND EMOTIONS		114
PART TWO • <i>Learning and Adjustment</i>		
VIII. THE LEARNING PROCESS		131
IX. THE LEARNING PROCESS (CONTINUED)		164
X. SENSATION AND LEARNING		204
XI. PERCEPTUAL LEARNING		216
XII. ASSOCIATIVE LEARNING		229
XIII. THINKING AND LEARNING		251
PART THREE • <i>Measurement of Behavior</i>		
XIV. MEASUREMENT OF INTELLIGENCE		273
XV. EDUCATIONAL MEASUREMENTS		289
XVI. ELEMENTS OF STATISTICAL METHOD		315
PART FOUR • <i>Personality and Adjustment</i>		
XVII. PSYCHOLOGY OF GUIDANCE		347
XVIII. PSYCHOLOGY OF CHARACTER		372

CHAPTER	PAGE
XIX. PERSONALITY DEVELOPMENT AND INTEGRATION . .	396
XX. PERSONALITY DEFECTS AND ADJUSTMENTS	414
XXI. PSYCHOLOGY IN SCHOOL RELATIONSHIPS	450
GLOSSARY	469
INDEX	479

PSYCHOLOGY FOR TEACHERS

PART ONE · *The Bases of Behavior*

CHAPTER I

INTRODUCTION: THE SUBJECT MATTER AND METHODS OF EDUCATIONAL PSYCHOLOGY

The fundamental aim of education is to change the individual so that he will be able better to adjust himself to his ever-changing environment. He must develop in definite directions and change in many respects his mode of behavior. Educational psychology is the discovery and application of the facts and principles of psychology in the field of education. Educational psychology studies the changes in the individual that will affect his behavior. The psychologist as an educator observes and interprets human reactions so that definite laws of growth and development may be formulated.

Our educational systems have been built upon current concepts of the nature of man. As leaders in psychology and education have accumulated new facts and developed new theories, changes in method have been made so that greater progress has been possible in shorter periods of time and with ever decreasing amount of effort.

It is within the province of teachers to help in changing human beings for the better. Teachers must act as guides to growing generations. The responsibility and obligation resting upon teachers is greater than that placed upon any equal number of persons in any other occupation or vocation. To meet this responsibility adequately the teacher

must understand the nature of the child. She must know how to stimulate, guide, and condition wants so that they will result in useful and worthy ideas, habits, attitudes, ideals, and interests. She must know the laws governing the behavior of human beings and therefore what is best to do under particular circumstances, and how to set up conditions that will result in the desired responses. The understanding of the behavior of children is essential to real teaching.

It is believed that a knowledge of educational psychology is worth while just to the extent that it makes a difference in the efficiency and effectiveness of one's learning and teaching.

The normal child comes into the world with a great many potentialities. Thereafter changes are being wrought within him every day of his life. Some of these changes are considered desirable for society, and teachers should learn to know what changes are desirable and how they may be produced. A knowledge of undesirable changes and the way they are produced will enable the teacher to avoid the situations which evoke these changes. A complete science of human behavior would tell us every fact about everyone's thinking, feeling, and acting. It would enable us, within reasonable limits, to direct and control the actions and changes that take place in human beings.

In the process of acquiring habits and skills, as well as ideas, ideals, attitudes, and interests, it is obvious that there is considerable waste in time and effort. A little observation reveals that this waste is largely owing to the fact (1) that the learner is not acquainted with the most efficient methods of learning, or (2) that he does not put into practice the principles that he has learned, or (3) that he needs guidance in learning.

Waste in time and effort can be largely obviated if the

learner and the teacher understand the difficulties in learning. The teacher must locate the difficulties and devise ways and means to avoid them or diminish them when they are too great for the student. Each pupil has a fund of experiences and a native equipment of wants and aptitudes. The teacher must learn how this native equipment can be utilized best and how the child's experiences may be built upon.

Science evolved from man's first attempt to understand nature. All sciences, being the result of human thinking, contain facts that are more or less useful in understanding mental life.

The work of the efficient teacher rests upon the science of psychology. If education is to produce changes in the individual, psychology should help point the way of doing this in the most effective manner. To this end psychology has changed the focus of attention from the subject matter to the learner. Education means growth and development, and growth and development mean changes. To pass through the process of being educated the child must change and be constantly changing as he adjusts himself to the world he lives in. Education may be considered a method of adjustment which results in continued growth. It should be considered a life process. In the final analysis it is an organization of experiences throughout life. Educational psychology attempts to bring about an economical and systematic organization of experiences.

THE MEANING OF PSYCHOLOGY

Psychology may be defined as the science of behavior. By behavior we mean more than muscular movements. Behavior includes all kinds of muscular, glandular, and neural responses. Broadly speaking, psychology deals with thinking, feeling, and acting. Consciousness itself, whether

peripherally aroused (in the sense organs) or centrally aroused (in the central nervous system), is just as truly the subject matter of psychology as are the more directly observable facts of muscular and glandular reactions.

Behavior involves reactions of muscles, glands, and nerves. Neural activities centered in the brain are often spoken of as thought, or consciousness. Conscious activities exist in varying degrees of complexity. These activities are composed of blends or combinations of sensations, images, feelings, meanings, and tendencies to action.

In this book consciousness and mind will be regarded as manifestations of organic life. They are known from the activities of the organism. They are neuro-muscular and neuro-glandular activities which are accompanied by awareness.

Mind may be thought of as identical with the sum total of mental states and processes in a lifetime. But mind is more than this. It is a mirror of past experiences in the sense that it enables us to bring past experiences to bear upon present conduct. But mind is still something more. It not only reflects the past; it also anticipates what is coming. In the sense that mind is always pointing to something new, mind is creative. Mental life is continually changing life. Conscious behavior is experimental in so far as past experiences modify present conduct and the direction of this conduct is controlled by the projected future. Bode says that it "is essentially experimental, forward-looking, controlled by the future."¹

Obviously consciousness and mind are abstractions. They make up our world of reality, our mental life. It is with conscious activities that educational psychology is chiefly concerned. It is for this reason that psychology is fre-

¹ B. H. Bode, *Fundamentals in Education*, p. 216. The Macmillan Company, 1921.

quently defined as the science of mental life or as the science of mental activity.

Psychology seeks to describe and explain the individual's experiences. Psychology interprets all the activities of man and furnishes a basis for the study of every form of human relationship. Psychology thus affords a sound basis for the study of sociology.

Psychology endeavors to study how and why a human being behaves as he does. A knowledge of psychology is of value in every walk of life. It helps us to understand ourselves and our fellow beings, to adjust ourselves to ever-changing surroundings and conditions, and to solve many of the difficult problems which arise from our relations with others.

Human behavior is largely determined by its biological and sociological foundations. It is impossible to understand human behavior and its development without some knowledge of the bodily structure of the human being. All human life is lived among social surroundings. Without the social heritage, man would act, think, and feel on a level with the most primitive savage. The language the child speaks, the traditions, customs, moral codes, and religions are the product of centuries of striving and endeavor. These race experiences are passed on to the next generation. The child begins with the end products of the race. In this way progress is assured.

What is educational psychology? Educational psychology selects from the total field of general psychology those facts and principles that are of special significance to learning and teaching. It is concerned with all phases of mental growth and development of human beings at all ages. Its subject matter includes all forms of human behavior involved in the educational process, such as the behavior of children at birth, how children learn, learning the special school subjects, pupil adjustment and guidance, and indi-

vidual differences. Educational psychology as a science seeks to collect, organize, describe, and interpret human behavior so that the facts and principles may be utilized in learning and teaching. With the development of this science, the teacher has gradually substituted a scientific procedure for a mere guesswork or accidental procedure. The result has been an enriched experience gained more efficiently by the learner, and more artistic teaching.

The facts of educational psychology are more than mere opinions. They represent the accumulated results of experiments in the laboratory, test studies in the classroom, case histories, and in addition relevant contributions of educational sociology and educational biology, as well as the special divisions of psychology — general psychology, applied psychology, social psychology, genetic psychology, animal psychology, clinical and abnormal psychology, and psychiatry.

Educational psychology should enable the teacher to understand human nature, to know something about the changes taking place in individuals, to understand the laws governing the learning process, and to recognize and understand variations in groups. Its purpose is to give such information as will enable the teacher to help the growing child to acquire information, skill, and character, and adjust himself to the forces acting upon him, to the end that he may develop the potentialities within him.

Methods of getting data in educational psychology. The data of educational psychology are secured through the use of the scientific method known as observation. Cases of learning and of mental development must be observed, and the data secured in this way must be subjected to the rigorous treatment common to all scientific study.

Studying directly observable behavior is called the *objective* method of observation. This method is that em-

ployed in all the physical sciences. If a teacher wishes to determine the efficiency of pupils in spelling, she may do so by giving them a standardized spelling test. In this way she can check her pupils against the norm or standard. As the test and the method of giving it and scoring it are always described in detail, any competent person can administer the test, score the papers, and get the same results. In other words, the objective method gives results that are quite reliable and accurate.

In order to observe the phenomena of consciousness, it is necessary to use the *introspective* method of observation. Introspection is a systematic process of self-observation. It is subjective observation. When the introspections are reported after the mental activities were experienced, it is more properly called *retrospection*. This is valuable in integrating and harmonizing experiences.

Introspection differs from the objective method in having one's own internal mental states and operations as its object rather than the facts and events of the outside world. If introspections are carried out carefully and systematically by trained observers, the results are quite trustworthy. The teacher may note, for example, that her classes are having certain difficulties in learning a given topic or subject. If she will recall some of her own difficulties attending the learning of some new subject or process when a student, it will invariably help her to stimulate and guide the students over similar difficulties. This recall and observation of her own mental processes was accomplished through the use of *retrospection*. The introspective method is thus a useful adjunct and complement of the objective method, whether we are dealing with children or adults.

In order that objective and introspective observations may be as reliable as possible, it is often necessary and advisable to make the observation under controlled condi-

tions. We then designate our procedure as the experimental method. This method permits an exact repetition of conditions and may be used in connection with the objective or the introspective method. In this way it is possible to secure verification and acceptance or rejection of results by any competent observer. The experimental method has proved itself useful in extending the range of both subjective and objective observations. The microscope, for example, increases the range of human observation to the point where germs are observable. The telescope reveals to us the existence of planets and stars that cannot be seen with the naked eye. The moving-picture machine enables us to study movements involved in the performance of an activity. These and other pieces of apparatus may be brought to the aid of experimental observation.

The experimental method is scientific. Its use facilitates the preciseness and the reliability of the observation. Scientific procedure is mathematically precise. Scientific investigations can be repeated exactly by any competent person in order to verify the conclusions. In order that such repetition may be possible, it is necessary that each step in the investigation be fully described. Persons who are given to uttering mere opinions seldom take the time and trouble to give thorough account of the sources from which their opinions are derived. Scientific verification needs only a person competent to understand the description and able to duplicate the work.

Scientific experiments must be organized by experts. Only persons who have spent considerable time and effort in studying and perfecting techniques are capable of making a scientific investigation. Finally, scientific investigations must be impartial. The experimenter must be free from bias at every stage of investigation. His desire is to ascertain the truth.

Stages in scientific investigations. We find no less than three stages in any systematic or scientific investigation. In practice the thinker or investigator thinks while he observes and observes while he thinks. The first stage in systematic investigation is observation; the second is the formation of and development of hypotheses; and the third is their progressive testing and verification by renewed observation. These steps are fairly well defined, but in actual investigation they do not exist in isolation. Each of these steps is confronted by intellectual dangers and hazards. It is in surmounting these that we find new facts and principles of importance. Every scientific investigation necessitates intensive, systematic, and persistent mental activity under control against misunderstandings, superficiality, and bias. It further necessitates complete loyalty to reality and the truth. The scientific method begins with the gathering of data on the problem within a selected field according to some adequate plan. The observations must be numerous and accurate. The human senses must be aided and corrected by instruments of precision whenever this is possible.

Scientific observations are usually made with a well-defined purpose. The observations must be recorded in definite terms and measurements, and in specific statements. The investigator must distinguish between data which are relevant to his problem and those which are irrelevant. Having gathered relevant data he must be capable of classifying them.

Having gathered and organized his data, he must now make fruitful conjectures as to the causal relations which hold between facts or which lie behind them. He must generalize so as to get his principles and theories into tentative form. He must have an active and constructive imagination and a keen insight into all possible relation-

ships and causal connections. Finally, he must verify or annul the findings. Another element of an investigation is the deduction of implications from the theories advanced. The interpretation of the hypothesis is developed as completely as possible and its implications are noted. When confronted with several possible and rival hypotheses in his search for an explanation of the observed phenomenon, the investigator will generally accept the explanation that explains the most and explains it in the simplest way. One must accept that hypothesis, however, which best fits all the facts.

General truths, or laws, are arrived at gradually as a rule. The first step in their development is the bold *guess* or hypothesis. The next step in the development of general laws or principles is the *theory*. Here the *hypothesis* is supported by further observations. When the theory is shown to be generally applicable it becomes an accepted *principle*.

Contributions of the special fields to educational psychology. Many extensive studies which have practical value have been made of children and adults at different levels of age, social development, and intelligence. This reasonably distinct branch or method of investigation is sometimes called genetic psychology. Stanley Hall's studies of child life and adolescence, Watson's studies of emotional responses in the nursery, the studies of Baldwin and Gesell of pre-school children, and Meek's study of the social development of pre-school children are classical examples of genetic psychology.

Study of mental abnormalities constitutes another subdivision, known as abnormal psychology. Those aspects of abnormal psychology which deal with the psychology of the exceptional child, of the unadjusted and unstable child, and the mental hygiene of childhood and adolescence belong also to the province of educational psychology.

The influence of social psychology has been very great.

The child's behavior is primarily the result of his biological and social inheritances. The individual's native equipment of instincts and capacities, as well as such physical traits as the color of the hair, eyes, and skin, is the result of biological inheritance. The particular language he acquires and the customs, traditions, and religious beliefs that mold him are the products of civilization. These affect his behavior no less markedly than biological inheritance. Furthermore, the part contributed by social organizations and institutions plays a dominant rôle. The church, the school, the home, the group, the community, and the state are constantly determining to a very large degree the behavior of every individual.

Mental development means the gradual development of mind from its first faint beginnings to its vastly more complex and highly organized forms. This growth or development shows itself in the change of mental levels and in ability to deal with increasingly complex and abstract problems and to respond to smaller and less obvious stimuli. The emotional development also shows itself in the change of emotional levels. Motivation likewise shows a constantly changing level. These changes constitute the development of the child's mind. Education seeks merely to stimulate, direct, and extend this process.

The changes that this growth involves constitute the field of two related branches of the science of psychology: (1) genetic psychology, referred to above, which deals with the growth of mind in either the individual or the race; and (2) comparative psychology, which studies the behavior of lower animals as compared with that of the higher animals and the behavior of primitive man as compared with that of the civilized, and through these comparisons attempts to learn how mind is developed in the race.

Animal psychology contributes much to a proper under-

standing of human behavior on the lower levels of conduct, but it has less to offer towards an understanding of human behavior at higher levels, where the higher processes of thought are involved.

The use of tests and measurements and statistical devices has enabled us to accumulate a large body of quantitative data. In this manner it has been possible to determine the nature and extent of a pupil's deficiencies, and the comparative effectiveness of different methods of learning and teaching. Tests and scales have also served the purpose of motivating learning; and as a means of verifying or refuting the claims of any method.

A course in educational psychology should give the basic psychology for all educational methods. It should contribute to the teacher's educational philosophy. It should enable the student of educational sociology to understand the relationship between groups as well as between individuals.

Educational psychology lays the foundation for a study of mental maladjustments, behavior problems, and the integration of personality. It should furnish the information necessary for the guiding of the learner in the successful acquisition of knowledges and skills, as well as the conditioning of his physical and mental machinery for the formation of wholesome character traits.

QUESTIONS

1. Why is psychology of value to people in all walks of life?
2. Do you think that psychology is the science of human behavior? Why?
3. Illustrate the methods of securing data in psychology.
4. How does an experiment differ from ordinary observation?
5. How should the investigator be trained for scientific work?

6. Of what value is a knowledge of statistics?
7. When does a guess become a fact?
8. List the different fields where a knowledge of psychology is valuable.
9. Of what value is psychology to the teacher?
10. What is your aim in education?
11. What is the ultimate purpose of psychology?
12. How does educational psychology differ from psychology?
13. What is method?
14. What is subject matter?
15. What is the subject matter of educational psychology?

REFERENCES

- BOLTON, FREDERICK E. *Everyday Psychology for Teachers*. Charles Scribner's Sons, New York, 1923.
- FOX, C. *Educational Psychology*. Harcourt, Brace and Company, New York, 1926.
- GIFFORD, W. J., and SHORTS, C. P. *Problems in Educational Psychology*. Doubleday, Doran & Company, Garden City, 1931.
- HOLLINGWORTH, H. L. *Educational Psychology*. D. Appleton and Company, New York, 1933.
- JORDAN, A. M. *Educational Psychology*. Henry Holt and Company, New York, 1928.
- MONROE, W. S., DEVOSS, J. C., and REGAN, G. W. *Educational Psychology*. Doubleday, Doran & Company, Garden City, 1930.
- PINTNER, RUDOLF. *Educational Psychology*. Henry Holt and Company, New York, 1929.
- STARCH, D. *Educational Psychology*. The Macmillan Company, New York, 1919.
- THORNDIKE, E. L. *Educational Psychology*. Teachers College, Columbia University, 1913-1914.
- TROW, WILLIAM CLARK. *Educational Psychology*. Houghton Mifflin Company, Boston, 1931.

CHAPTER II

ORIGINAL NATURE

It is a common observation that human beings differ greatly in certain respects and appear much alike in others. These differences are most pronounced in the capacities to learn (intelligence) and are least noticeable in tropisms, reflexes, and instincts.

Man comes into the world equipped with a certain organization of living matter which enables him, sometimes with assistance, to make the relatively simple adjustments necessary for life. The neural mechanisms involved enable him to act in rather specific ways. These patterns of behavior, for the most part unlearned and automatic, are an endowment from the species and family strain.

Just as the child inherits physical traits, such as the color of the hair and the texture of the skin, he inherits behavior traits and predispositions to traits. The first movements of an infant, his activity in nursing, crying, sleeping, and random movement, are not learned. His protoplasmic organization, especially the neural equipment, enables him to do these things for strictly biologic ends. This bodily organization makes it possible for him to grow and develop, both physically and mentally. This endowment of behavior trends furnishes the basis upon which we can build; it furnishes the foundation for all learning and education. It serves man throughout his life; during early infancy particularly, it is an "emergency equipment."

In many of its aspects original nature is readily modifiable by personal experience. Pure instincts, for example,

exist only the first time they function, and thereafter there is a combination of native and learned elements. In brief, that which is innate and unconditioned gets overlaid by modification in response to environment and adaptation from the very first day.

TROPISMS

Tropisms, or physico-chemical responses toward or away from stimuli, play a minor rôle in human conduct, since man's adjustments are effected primarily by neural mechanisms.

REFLEXES

The student of human nature is interested in reflex behavior. A reflex is a very simple act induced by a stimulus. It is carried out without premeditation or choice and is involuntary in character. Although the mechanism involved is relatively simple, there are many kinds of reflexes. A specific reflex act, such as the "knee-jerk," manifests no variability except in intensity and time for its performance. Some reflex acts are relatively pure. They can be modified, if at all, only slightly. Others are more subject to inhibition, reinforcement, and modification by conscious control. Some are pure in infancy but consciously modified in the adult. The pupillary reflex of the eye is an illustration of the first type; and sneezing or coughing, capable, within certain limits, of conscious control, illustrates the latter type. Education, obviously, is concerned with the more modifiable reflex acts. Tampering with the relatively pure reflexes may result in considerable danger to the health.

The reflex-arc concept. Man's nervous system is organized into paths that are essential to the individual for living and learning. These paths, which are fundamental wholes, involve sensory, connecting, and motor nerves. Even the

simplest of these reflex arcs, as they are called, involve many nerves, while the more complex reflex arcs in man involve millions of nerves. Thousands, if not millions, of permutations and combinations of reflex arcs are possible. The reflex arc is the fundamental physiological mechanism of adjustment and behavior. Many of the reflex arcs are susceptible to modification and reorganization. (See Figs. 1, 2, pp. 58, 59.)

INSTINCTS

The instinct concept. Instinct is a term that appears to be used less and less owing to the fact that it has no standard meaning. Practically the term has no meaning except as defined by the person who uses it. Any definition may be considered as fairly satisfactory from one standpoint, if used consistently.

As Woodworth¹ points out, "The argument that the concept of instinct is superfluous because all that is inherited reduces to structure would rule out habit, reflex, and emotion as well. To drop the one and keep the other would necessitate a complete recasting of the descriptions of behavior. The argument emphasizing the impossibility of distinguishing native from acquired behavior appears illogical, since it would likewise necessitate the dropping of all mention of acquired activities."

The fact is, there is need of some term to denote unlearned behavior and another term to denote learned behavior. Terms like instinct and habit are useful in considering the various aspects of behavior.

The "instinct theory" asserts that activities which exist

¹ R. S. Woodworth, "A Justification of the Concept of Instinct," in *The Journal of Abnormal and Social Psychology*, Vol. XXII, (1927), pp. 3-11. In his "Psychology," Revised Edition, Woodworth appears much less certain of the value of the instinct concept (see pp. 218-221, 246).

at birth or soon after, which are fairly universal in appearance, and which appear without opportunity for the individual to learn, are the results of inner development depending upon the genes which existed in the germ cells at the beginning of the individual life. More specifically, the instinct hypothesis assumes that coördinated reactions to definite situations, existing at birth or later as a result of inner maturing, are native or unlearned.

Instinctive tendencies have been described as a series of chained reflexes. According to this conception, each reflex is induced by the stimulus of the response in the preceding reflex. According to another view instinctive tendencies involve more than a single reaction system. In instinct many units or systems are involved; whereas in a reflex there is but one reaction system. The rivalry tendency involves, for example, not a reaction in a single reaction system but many highly complex, interrelated, and integrated reaction systems that continue to function until certain conditions are fulfilled.

Instinctive acts are characterized by spontaneity, variability, and relatively great adaptability by modifications. Instinctive actions or tendencies may become integrated into more complex reactions when the need exists for such reactions. In the child, for example, the behavior conditions are so complex that there are only a few instinctive-action tendencies, but these few become integrated into larger action patterns. The unlearned tendencies disappear in the learned. This text takes the following position in regard to instinct:

1. Instinct involves unlearned or native responses of greater complexity than reflexes. They are conditioned by the structure and organization of the organism. Unless modified, instinct operates independently of voluntary control and necessarily without foresight of ends.

2. The neural mechanisms involved are innate, or inherited as a functional unit from the species and the race, and are of few distinct types.

3. The reactions are initiated or aroused by specific but variable situations, that is, by external or internal stimuli. The reactions are adapted to the preservation of the organism or to the preservation of the species.

4. Psychological tensions lead to specific types of uneasiness and dissatisfaction on the part of the organism until relieved by specific substances or muscular activities.

5. Instincts are often quickly modified by individual experiences. Human activity, after the beginning, involves an entangled mixture of unlearned and learned elements.

6. Instinct patterns may be inherited, may be acquired before birth, or may come to expression in later life as the body matures (maturation). It is difficult to distinguish maturation from learning, as normal growth is a continuous adjustment to environment, seeming to respond to inner stresses and tensions.

THE MATURATION HYPOTHESIS

Maturation is a term used to denote a natural growth and ripening or development of abilities, traits, and functions, which are attributable chiefly, if not wholly, to innate and endogenous factors. Maturation is not a result of learning or training but rather of inner maturing, which is dependent upon heredity, a physical condition, and an environment.

Studies of animal behavior lend very substantial support to the maturation hypothesis. Studies made of pre-school children by Gesell and others are convincing.

Gesell¹ notes that the child's behavior patterns follow an

¹ Arnold Gesell, *The Guidance of Mental Growth in Infant and Child*, pp. 277 ff. The Macmillan Company, 1930.

orderly genetic sequence in their emergence. His statement of evidences of maturation is here summarized.

(a) The development of prehension, or grasping, throughout the first year. The genetic studies of the child's reactions to a small pellet suggest that maturation, not experience and training, is the explanation for the changes noted in the reaction.

(b) A study of developmental correspondence in twins gives further support to the theory. Gesell observed under controlled conditions a pair of identical twins. At the age of 28 weeks, both the twins seemed unaware of the pellet, though they noted the cube. At the age of 38 weeks, both noted the pellet in the same manner. At 40 weeks, both made crude, slashing attacks on the pellet, and again at 42 weeks, without further experience, they again attacked the pellet in a way very superior to what they had done only two weeks before. These changes and correspondences in the prehension patterns point to maturation as the factor responsible, since it seems utterly impossible for identical conditioning factors to have arisen in the environment.

(c) The effect of maturation may be observed by noting the limitations of training. In an experimental study, Gesell used a pair of identical twins (Twin-T and Twin-C). By various tests, when they were 46 weeks of age, he assured himself of their mental and physical likeness. He determined the influence of training by training Twin-T and reserving Twin-C as a control. Twin-T was trained for 20 minutes each day for a period of six weeks, in stair-climbing. Twin-T was able to climb the stairs with slight assistance at 48 weeks, and at 52 weeks she could do it very well. Twin-C could not climb the stairs at the age of 52 weeks, but at the age of 53 weeks she climbed the stairs without any assistance and without any previous training. Twin-C's form and the efficiency of her pattern of climbing were the result, almost wholly if not entirely, of maturation. Other experiments with this pair of twins showed the same influence of maturation.

(d) Extrinsic factors, such as malnutrition and disease, have a restricted influence upon the complex of growth and maturation. Such factors do not usually "inflict any drastic changes upon the forms of fundamental behavior patterns and upon the

genetic order of their sequence" (page 288). "The relative immunity of the behavior patterns from these environmental deviations again bespeaks the firmness of maturation factors" (page 289).

(e) Finally, developmental progression in emotional behavior bespeaks maturation. Simple original tendencies like fear are "subject to genetic alterations of organic growth as well as to organization by environmental conditioning." Conditioning may "determine the orientation and reference of fears," while the mode of fearing changes as the result of maturation. Fear, like prehension, is shaped by intrinsic maturation as well as by experience, during infancy at least.

The facts that support the maturation hypothesis suggest that many problems in classroom behavior are created by trying to force learning on children before they are sufficiently mature to learn with ease and interest. If formal instruction in subjects ordinarily taught in the first grade were delayed until the child is physiologically ready, learning would progress at greater speed and with greater comprehension and interest. Failures in mastering the mechanics would give way to joy in successful performance.

By this time the student has probably asked the question, "Have we any instincts?" What criteria shall we apply to activity if we would determine whether or not the activity is instinctive? An organism may be said to behave instinctively (1) when all opportunity to learn the behavior has been prevented, that is, when it occurs without any previous experience; (2) when practically all individuals behave in the same way and as well the first time as at a later time; and (3) when the behavior exists from birth, or, in most cases, from early life. Certain types of behavior do conform to these criteria. We may be said, therefore, to have instincts, but probably not so many as James and Thorndike have maintained. That considerable disagreement exists as to the instinctive character of many traits was

amply illustrated in a recent study. From an examination of seven standard textbooks, it was found that acquisitiveness, combativeness, fear, gregariousness or sociability, maternal love, and sex were considered unanimously as human instincts. Only six mentioned constructiveness, sympathy, rivalry, and secretiveness; five named feeding, curiosity, and self-assertion; four named hunting, imitation, and jealousy; three mentioned repulsion, submissiveness, shyness, modesty, play, walking, cleanliness, and coöperation; two included vocalization and bullying; and there were eleven additional traits each mentioned in but one book. Only sixteen out of a total of thirty-eight alleged instincts were mentioned by a majority of these texts. One of the more recent classifications of instinctive responses follows:¹

- (a) Adjustment of the sense organs to stimuli
- (b) Seeking and accepting reactions
- (c) Protective reactions
- (d) Locomotion
- (e) Vocalization
- (f) Manipulation

INSTINCTIVE BLENDS

There are few separate, independent, specific tendencies that can be called instincts. Every reaction involves the whole organism — sense organs, muscles, glands, and nervous system. The bodily condition is never twice alike. The environment which constitutes a part of the total situation is never twice alike. Consequently, there can be no one-to-one correspondence between situations and instinctive acts. For example, it has been assumed by some that there is a single instinct of fear. In reality, when one is afraid he reacts with his whole being, which is never twice the same. The situations which evoke responses are chang-

¹ See Gates's and Thorndike's books.

ing situations. There is not one fear, but as many qualitatively different fears as there are situations responded to and sensed. The reaction is original when it first occurs. As conditions are always different, such a reaction is always new in the sense that this particular reaction never occurred before. Instinctive behavior is constantly being modified or changed in the light of experiences. For these reasons, we should probably think of instinctive processes or tendencies as opposed to the term "instincts," which implies a fixed set of acts. The adjective emphasizes the presence of tendencies attributable to instinct in blends or complexes with other tendencies.

THE VALUE OF INSTINCT

Innate bodily tendencies serve several important functions. Some of them, like digestion, voiding of waste products, sleeping, and adaptation to changes of temperature, are adaptive. The "fighting tendency," while of paramount importance to the race, requires control. Many instinctive responses provide a native basis for protection and defense. Avoiding, self-assertion, and fighting serve this function, but in modern society serve it best when modified. The bases of many occupational skills are to be found in manipulation, while vocalization, gregariousness, desire for social approval and avoidance of scorn, including self-assertion, submission, and fighting, are involved in adaptations of one individual to another. Human personality is rooted in the native equipment of the individual. Learning is often initiated and motivated by instinctive drives.

The educator is concerned chiefly with such instinctive tendencies as general mental and physical activity in addition to the many specific activities such as manipulation, collecting, owning, curiosity, rivalry, play, gregariousness, pugnacity, love of approval, mastery, submission, and imi-

tation. To their stimulation, inhibition, direction, and redirection the teacher should give much thought and attention.

Instinctive activities serve a purpose. As judged by the standards of modern society, they are neither good nor bad. There are but few that serve man best without any modification. Some, such as bullying, call for radical redirection or thwarting. Instinctive traits are to be discovered in functional relationships, and used in the process of changing man for the better. All learning, regardless of the time, place, or manner in which it takes place, affects these original and instinctive traits. Naturally it is important that they be modified as economically as possible in the interests of both the individual and society. Authorities have suggested various methods by which instructive tendencies may be modified.

MODIFICATION OF NATIVE BEHAVIOR PATTERNS

The child is born with the ability to make relatively few movements besides those of the vital organs. He is not able to walk, talk, or direct the movements of his eyes, hands, or limbs. The activities that he is able to make are largely of a reflex or instinctive nature. It is these unlearned forms of behavior, however, that furnish the basis for all learned behavior.

Some of the child's acquisitions may begin before birth. Certainly from the moment of birth onward learning normally progresses rapidly. Unlearned or native actions and tendencies are modified with every expression so that by the time the child enters kindergarten his activities represent a blend of reflexes, instincts, habits, and volitional elements. The capacity to learn varies from one child to another, the brighter child being able to acquire new behavior patterns better and more quickly than the subnormal.

"Learning" is a term that has long been used to describe the child's acquired patterns or forms of behaving. In a broad sense, all learning involves the acquisition of information, skills, and attitudes. Some habits, like walking, become so automatic that there is little feeling involved. In other cases, learning may be deeply tinged with feeling, as in the case of attitudes, interests, appreciations, and standards of values.

Let us note the nature of the child's activities immediately after birth and observe how these simple beginnings become greatly modified with growth and experience. Careful studies of infant behavior have been made by Watson, Gesell, Buhler, and others.

At birth, the infant performs the physiological acts incident to sleeping, circulation, respiration, digestion, and elimination. In addition, there are such subsidiary responses as yawning, sucking, swallowing, regurgitation, hiccupping, spitting, vomiting, and sneezing. While all the sense organs appear to be functioning, the resulting sensations are obviously lacking in clearness and meaning. Movement of the head toward the light, signs of discomfort, and poorly coordinated movements of the eyes may be observed. The infant cries at loud noises, shows rage when his limbs are held so as to prevent movement, manifests fear when support is quickly withdrawn from under him, and smiles as early as four days of age when sensitive areas of the skin are gently stroked, when rocked, or after a satisfying meal. Only a few infants can hold up their heads for a few seconds at birth. By three days of age, most infants will raise their heads when their faces are buried in a pillow. The infant is able to grasp the finger of the nurse sufficiently tight to support its own weight a few seconds. When thus suspended, the child responds with climbing motions of the trunk and legs. Some infants are able at

birth to turn over when placed lying on their stomachs. The child is able to open and close the hands, spread and stretch the fingers, and grasp with the palm of the hand when it is stimulated. Slight stimulations of the skin usually provoke marked movements of the hand, wrist, arm, and shoulder. Avoidance movements may be elicited by tickling the foot. Not until the child is several months old will he stiffen the muscles of the legs and attempt to support himself in standing position. Out of these simple movements of trunk, arm, leg, and foot the child learns combinations that result in sitting, balancing, standing, and walking. From more or less random, trial-and-success, or diffuse movements emerge definite and precise movements. From unlearned responses develop our learned activities in ever-extending fields. From the great variety of animal-like cries found in the nursery, from the rambling and meaningless babbling, certain vocalizations produced either by accident or through imitation are selected. Successful movements are selected, as it were, because they bring results; unsuccessful activities are eliminated.

Habit-forming or learning is possible because the human structure and organization admit not only of unlearned responses but also of their modification and the formation of new connections or bonds and their retention as deposits of experience. This characteristic is generally called plasticity. The ease with which children form bonds, or connections, and retain these as deposits varies from individual to individual. Moreover, plasticity seems to be slightly greater in early life—that is, up to thirty—than later, other things being equal.

Conditioned reflexes, or associative shifting. The child learns through experience. Learning on the part of the child may mean that he is being conditioned or reconditioned. In other words, by “conditioned reactions” is

meant habit formation, or learning; but all learning is not a matter of conditioning in any limited sense. The way in which some habits are formed is as follows: the original repertoire of reflex and instinctive actions and tendencies soon becomes greatly enlarged (*a*) by making old responses to new stimuli, and (*b*) by substituting new responses to old stimuli. This process can be made clear by the following illustration. The young infant just learning to walk attempts to reach out for a moving object called a dog. Simultaneously with the reaching, the dog barks loudly and bites the child. Both the loud bark and the pain from the bite arouse the child's original reaction of fear. The child has been conditioned. Thereafter he makes a new response to the dog that barked and bit him. Fear takes the place of reaching for it. This is a *substitute response* to the old stimulus. The new response may transfer to other situations where any dog is the stimulus. Such a stimulus is then called a *substitute stimulus*.

Take the case of loud noises provoking fear in the infant. As the child develops he learns that the noises are harmless. He no longer screams upon hearing them. The process whereby an originally adequate stimulus becomes inadequate to elicit a response is called *negative adaptation*. Social repression in which the individual inhibits normal responses to others is another example of negative adaptation.

Food presented to a dog excites the flow of saliva. If for a number of times a bell is rung at the moment the food is presented, the flow of saliva may be elicited simply by ringing the bell. Such a response to a substituted and originally inadequate stimulus is called a *conditioned response*. When responses become attached to stimuli that did not originally elicit them, we have a case of *positive adaptation*.

In the growth of the child's behavior his responses become progressively adapted to the situation confronting him, by the elimination of useless and superfluous responses and the stamping in of the success-getting movements. This process involves positive and negative adaptation.

The cases cited constitute *conditioned responses of the first order*. The ramifications and increasing complexity of behavior as the child grows can be understood when we remember that each of the new responses made may be attached to other stimuli and that other stimuli may call forth a variety of other responses. We have, accordingly, conditioned responses of the second order, third order, etc. Modifying conditioned behavior is called reconditioning. The technique for reconditioning is the same as that for conditioning.

All this may seem more technical than practical, yet this is the technique that is often used, with or without deliberation, by the learner in the formation of many habits and attitudes. It is very doubtful, however, if the technique of the conditioned reflexes is the best technique to employ in all learning situations. In some simple situations it is fairly satisfactory; but even in these, as well as others where *complex* patterns of behavior are to be modified, this technique is altogether inadequate.

If we would perpetuate a desirable instinct or native trait, we should make certain that acting in the desired manner is associated in the learner's mind with some satisfaction. That is, the activity should be accompanied or followed by some satisfaction. Praise of a boy's efforts at the construction of a boat or airplane is highly satisfying to him. The tendency is for him to repeat the activities that are pleasure-bringing. Many activities bring their own reward in satisfaction, owing to the fact that they are ac-

accompanied or followed by success or interest. The boy who blows a bugle or who whistles gets a satisfaction from the accomplishment or the resulting sound.

If we would thwart an instinct, the process must be reversed. The activity must be accompanied or followed, in the learner's mind, with annoyance or dissatisfaction, since tendencies are weakened when the effect is unpleasant. If a boy is severely reprimanded or punished by the members of his gang or scout troop for bullying a smaller boy, he is less likely to do it again, as the disapproval of the group is definitely associated in his mind with bullying the boy. When punishment or dissatisfaction is used, care must be taken that the penalty administered is associated in the child's mind with the wrong deed, not with the individual who administers the punishment.

Instinctive activities may be weakened under certain conditions if little or no opportunity is given for their expression. Similarly they may be strengthened if adequate opportunity is given for their expression, provided, of course, that satisfyingness attends the expression. The instinctive tendency to collect may be directed to the acquisition of stamps or geological specimens by such activity of one's classmates. Drugs, poisons, and dangerous objects must be kept out of the reach of young children, so that they will not be injured. The method of disuse, as it applies to the modification of instinctive acts and tendencies, applies primarily in the case of the young, the incompetent, and the ill.

Occasionally a desirable activity can be substituted for an undesirable one. Thus the undesirable trait is prevented from expressing itself or is eliminated, and the desirable one is stimulated or established. Instead of allowing the fighting tendency to express itself in primitive physical combat, we may substitute boxing or punching a bag. Fighting for one's ideals in a discussion may be substituted for fighting

with fists. When substitution is made on a higher level, "sublimation" is the name given the process. Fighting and sex-activity are chief among the tendencies that at certain times need to be sublimated. Sublimation usually involves some modification in the individual's ideas, ideals, and emotional attitudes.

INTELLIGENCE

The capacity to learn involves mechanisms that are more complex than those of instinct. In instinct the patterns are either preformed or develop naturally as the organism matures. In intelligence, or the capacity to learn, there are, in addition to the preformed patterns, innumerable potential patterns that depend upon experience. Thus capacity implies that neurone patterns can be formed and developed so that new reactions can be made. Capacity also implies a high degree of plasticity. In reflexes the patterns are definite; in instinct they are relatively indefinite; and in capacity the patterns are the most indefinite of all. In capacity we find that the patterns or bonds are most modifiable, most subject to control, and most variable. The normal man never uses all his possibilities for learning, so innumerable are his potential bonds or connections. As the quality of the human nervous structure or organization varies from individual to individual, the capacity to learn also varies. Some nervous mechanisms are more plastic than others, and the degree of plasticity appears to remain relatively the same throughout life, barring serious illness or accident. Man's degree of brightness, accordingly, appears to remain about the same so long as there are no radical changes in his physical condition or environment. Capacities require a favorable environment and educational opportunities if they are to find expression on the higher levels.

Through historical times man has been aware of striking

differences in the ability of individuals to learn and to adapt themselves in all sorts of new and novel situations. Teachers note these differences in the classroom. Even parents note that their children do not all learn the same activities equally well or quickly. These differences may be attributed to heredity, environment, health, degree of maturation, and education. Heredity determines in a measure physical stature, the size and texture of the brain, and all sorts of physical traits. The brain, in turn, plays a tremendously important rôle in determining man's reaction. The brain of a superior individual differs from that of an idiot. A good brain makes intelligent action possible if the other conditions of the right kind are present. A child with superior equipment at birth reacts in a superior way; but if this same child be placed, at the age of one year, on a tropical island far away from all other human beings and human culture (assuming it could survive the rigors of the environment), its superior brain and body equipment would count for little. On the other hand, the best environment in the world cannot make an intelligent individual out of one that possesses the brain of the idiot.

The term "intelligence" (general plus special abilities) has been used to note the individual's ability to learn or to adapt himself adequately to relatively new situations in life. The ability to learn is always the resultant of all the factors involved at that moment. That is, a child's intelligence is always a matter of the equipment with which nature endowed him, plus what he has learned, plus his general set, attitude, or physical condition at the moment. A child's intelligence is what he can learn plus what he has learned.

Other things being equal, intelligent individuals learn better and more quickly than dull ones, even though they use trial and error. They exhibit better memories, have

greater capacity for inhibition and for thinking. They can vary their responses with greater ease and effectiveness. They reason better and profit more from their experiences.

Several theories have been advanced concerning intelligence. According to one view, the unifactor theory (for example, that of Ebbinghaus), intelligence is general. It is a simple function. An individual bright in one subject is bright in all others, or vice versa. In this case if a student makes an A in one subject, he should make A's in all other subjects, and if he does not, it is because of lack of interest, a poor start, or some other extraneous factor. While much that is said in this connection is true, there are many exceptions that cannot be so easily explained away. Individuals are found superior in some abilities and low in others. These observations have led to the suggestion of a multifactor theory of intelligence. According to Thorndike, it is more appropriate to speak of intelligences than of intelligence. A third view, sponsored by Spearman, is known as the two-factor theory. Intelligence is a composite of "G," or general factor, and many special factors. Special talents and abilities are special factors.

According to Spearman, the "G," or general ability, functions more or less in every, or nearly every, activity. In learning such subjects as philosophy or science, achievement depends largely upon this general factor, whereas in learning music, art, and spelling, the "G" factor plays a lesser rôle since achievement in these activities depends much more on special aptitudes. In addition to possessing the special aptitudes known as musical talent, which is composed of many specific abilities or aptitudes, a great musician would necessarily possess likewise a high degree of brightness, that is, "G" ability.

Woodrow has suggested a modification of the Spearman theory. He asserts that there may be a level of intermediate

abilities between general ability and each of the special abilities. These intermediate abilities are assumed to be more specific than the "G" ability and more general than the special abilities.

In the final analysis the views held by Thorndike, Spearman, and Woodrow are not greatly unlike. In fact, they are in essential agreement.

Intelligence may be measured by specially prepared tests, of which we shall hear more later. In a very practical sense, intelligence is what these tests measure. Obviously, for these reasons and for others that are more fundamental, intelligence is not a fixed quantity. It is relatively fixed if we consider a large number of cases. In some cases considerable variability in degree of brightness may be noted.

QUESTIONS

1. What is a reflex? What is the instinct theory?
2. How would you set about proving the statement that the great difference in races is due more to environment than to heredity?
3. What evidence have we that prehistoric man had about the same native equipment that we possess today?
4. What is a reflex arc?
5. Just what is the maturation hypothesis? What has it to do with the problem of education?
6. How does a baby learn to walk? to talk?
7. Would a young bird know how to fly if it never had the chance to see other birds fly?
8. How may we make use in teaching of the tendency to manipulation?
9. Do you know of any animals which are not gregarious?
10. What are some of the most useful instinctive tendencies from the point of view of the teacher?

11. How can we tell whether any particular act of behavior is instinctive?

12. What are the features of an instinct according to the authors?

13. Cite experimental evidence that supports the maturation hypothesis.

14. What is intelligence? What is Spearman's conception of intelligence? How does intelligence differ from special ability?

15. What are some of the objections to the use of the term "instinct" in psychological and educational literature?

REFERENCES

- ALLPORT, F. H. *Social Psychology*, Chap. III. Houghton Mifflin Company, Boston, 1924.
- GATES, A. I. *Psychology for Students of Education*, Chap. IV. The Macmillan Company, New York, 1930.
- GIFFORD, W. J., and SHORTS, C. P. *Problems in Educational Psychology*, Chap. V. Doubleday, Doran and Company, Garden City, 1931.
- JORDAN, A. M. *Educational Psychology*, Chap. II. Henry Holt and Company, New York, 1928.
- PINTNER, RUDOLF. *Educational Psychology*, Part I. Henry Holt and Company, New York, 1929.
- RALSTON, ALENE, and GAGE, CATHERINE J. *Present Day Psychology*, Chaps. II and III. J. B. Lippincott Company, Philadelphia, 1931.
- THORNDIKE, E. L. "Original Nature," *Educational Psychology*, Vol. I. Bureau of Publications, Teachers College, Columbia University, New York, 1918.

CHAPTER III

NATURE AND NURTURE

How can we account for man's behavior? Is he a creature of heredity or of environmental circumstances? Or is he master of his own fate? These are questions that have been argued for years.

We shall attempt to show that man is a product of both heredity (nature) and environment (nurture), and furthermore that his own activities play an important part. Heredity and environment operate to produce a growing and learning organism that profits from its experience. In this sense man becomes the product of heredity, environment, and his own activity.

Nature and nurture, although interdependent, play different rôles. Certain traits are primarily due to heredity, others to environment. The color of the eyes is determined by the heredity materials; the particular language the individual speaks, by environmental influences. Much interest has centered in the relative rôles played by these two factors. That the two always operate together is recognized, but the biologist and psychologist to some extent have been able to distinguish the different rôles.

The two germ cells, or gametes, with which an individual starts life come from the two parents, one from each. In both of the cells there is a great diversity of material. Each of the twenty-four chromosomes in each of the germ cells contains genes, the bearers of heredity. The genes are very different for each egg and each sperm cell. In the process of forming the zygote, from which the embryo of the child

develops, the chromosomes from the two germ cells unite, and the particular combination formed is different from every other combination which might be possible. If we assume that each chromosome in the human germ cell has only one determiner, or gene, instead of the many which it actually has, the distribution of chromosomes during the division of germ cells and their recombination during the process of fertilization would yield 16,777,216 (2 raised to the 24th power) distinguishable individuals as the offspring of a single pair of parents.¹ Since the genes are determiners of individual traits and characteristics, it is obvious that we have here the fundamental basis for individual differences, so far as they are determined by heredity. Jennings has likened this chance combination of materials to "the drawings of a lottery, with the genes as the counters."² Mendel and subsequently many other biologists have worked out certain laws of inheritance based upon the statistical data, secured from many observations, which were related to the distribution of inherited characteristics through a number of generations.

Biological studies made of identical and nonidentical, or fraternal, twins add to our knowledge and understanding of the relative rôles or emphases played by nature and nurture. Identical twins develop from the same zygote and consequently from the same genes in the same combination. All differences noted in the behavior of identical twins in dissimilar environments are attributable to the influence of nurture. The nonidentical twins develop from two different egg cells and two different sperms. They develop from two different sets of materials from the parent stocks.

¹ See B. C. Gruenberg, "What we Know about Heredity and Environment," Brush Foundation Publications, No. VII. National Conference of Social Work, Boston meeting, June 14, 1930.

² H. S. Jennings, "Nature and Nurture," *The Survey, Graphic Number*, Vol. LXVI (April 1, 1931), p. 7.

When nonidentical twins of the same sex are reared in the same environment, we obtain some information regarding the specific influence of nature.

From comparison made of the two types of twins, biologists have noted that identical twins are always of the same sex and have the same physical features, profile, body, figure, and posture, as well as the same imperfections and the same tendencies to certain diseases. In the case of nonidentical twins we find the traits, including difference in sex, as diverse as in other members of the family.

The biologist demonstrates that identity of genes produces similarity in traits, and a diversity in genes produces dissimilarity. In brief, his studies show that physical, physiological, and even certain mental traits are influenced by one's biological nature, but they do not show to what extent prenatal and postnatal environmental factors have entered into the situation.

Lange¹ presents some interesting data to show that nature influences temperament, conduct, and mentality. From a study of prison records in Germany, he found thirty inmates who were each a member of a pair of twins of the same sex. By examining the record of the other twin of each pair, he ascertained that thirteen of the pairs were identical twins. Of these thirteen pairs of identical twins, one member of which was known to have a criminal record, the other also had a similar record in ten cases. An examination of records of the crimes committed revealed that both members of a pair of identical twins committed the same kind of offense. Criminal behavior, like all other behavior, is similar in identical twins. But in the case of the seventeen members of nonidentical pairs of twins, only in three cases did both members have criminal records, and their crimes varied in kind. The similarity in environment

¹ Johannes Lange, *Crime and Destiny*, Charles Boni, Publisher.

in the case of each pair of the seventeen did not result in a similarity in criminal behavior. These results suggest that identity of original nature results in identity of behavior as well as of physical features.

The fundamental nature of heredity is also suggested by such studies as that of Minogue. He found that the I.Q.'s of 441 feeble-minded children were relatively constant. When tested by standard tests of intelligence from two to ten years after the initial tests, those making the lowest initial rating varied less than five points and the others less than ten points. Minogue also found that feeble-minded children are more likely to show a loss in I.Q. than a gain. A similar tendency was found by Bonnis in a study of 200 cases. However, some other studies concerning the constancy of the individual's degree of brightness show greater fluctuations than Minogue's, indicating that physiological condition (or health), attitude (or emotional set), training, and education may affect the I.Q. as much as twenty or thirty points, though not usually more than seven.

Probably the earliest statistical investigation of this question of heredity was made by Sir Francis Galton in 1869. Galton's studies of "Hereditary Genius" and "English Men of Science" showed that genius runs in families. From his observations he concluded that genius was determined by heredity. The implication is that anyone who is gifted with genius will surmount all obstacles and make his own opportunities, regardless of environmental, social, industrial, and economic conditions. Since the children of genius have unusual cultural advantages, Galton did not conclusively determine whether genius was due to nature or nurture. In opposition to the Galton view, H. G. Wells,¹ placing emphasis upon environment, writes:

¹ The Outline of History, p. 589. The Macmillan Company, 1920.

England alone in the last three centuries must have produced scores of Newtons who never learned to read, hundred of Galtons, Darwins, Bacons, and Huxleys, who died stunted in hovels, or never got a chance of proving their quality. All the world over there must have been potential first-class investigators, splendid artists, creative minds, who never caught a glimpse of inspiration or opportunity, for every one of that kind who left his mark upon the world.

Such studies as those of De Candolle, Ward, and Cattell tend to the conclusion that the environmental factor is preponderant. De Candolle¹ analyzed the records of 552 scientists of Paris, London, and Berlin, with respect to the influence of nurture in accounting for their outstanding achievements. The conclusions are that these men accomplished what they did because they were able to secure a good education in their youth and were economically independent so that they could give full time to the pursuit of their interests. A number of other environmental factors were favorable, such as public opinion and freedom to speak and write their views.

Lester Ward² analyzed a study made by Odin of 6382 great men of France who lived in the five centuries preceding 1825. He found³ (a) that the rôle of physical and semigeographical environment in the production of genius had not been preponderant; (b) that race difference among the civilized groups was not an appreciable influence; (c) that the religious environment exerted only a perceptible influence; (d) that density of population is not a real factor in itself; and (e) that the educational and social factors are the real determinants of genius.

¹ Reported in Sandiford's "Educational Psychology," pp. 18-19.

² In "Applied Psychology," Part II, pp. 113-281. Ginn and Company, 1906.

³ Summarized by Ira W. Howerth, "Universal Education and the Increase of Genius," *Educational Review*, Vol. LXIII, January, 1922.

Ward's interpretations are probably too strong but of considerable interest. He writes:¹

So far as the native capacity, the potential quality, and "the promise of potency" of a higher life are concerned, those swarming, spawning millions, the bottom layers of society, the proletariat, the working classes, the "hewers of wood and drawers of water" — nay, even the denizens of the slums — . . . are by nature the peers of the boasted "aristocracy of brains" that now dominate society and look down upon them, are the equals in all but privilege of the most enlightened teachers of eugenics.

Cattell made a similar study of *American Men of Science*. His results indicate the powerful force of a social environment in the development of latent abilities. He finds that the number of geniuses produced in any given community is primarily a matter of educational opportunities. Pihlflad² summarizes the findings of Cattell as follows:

Cattell finds that the American scientists are many times more likely to be born in the eastern part of the United States than in the southern part; many times more likely to come from states with large cities than from those predominantly rural. He finds, for example, that a youth born in Massachusetts had fifty times as great a probability of becoming a scientist as a youth born in Alabama or Georgia. It would be hard to believe that selective influences working in the migration to these areas had produced in New England a stock fifty times more fruitful of scientists than the southern stock. A much more plausible explanation would find the difference attributable to the superior social stimulation of the towns, factories, small farms, strong churches, schools, colleges, libraries, and newspapers of New England — influences which were largely absent in the rural south of a generation ago. When he divided up his group

¹ *Educational Review*, Vol. LXIII, p. 55.

² "Possible Applications for Mental Tests to Social Theory and Practice," p. 32. Published Ph.D. thesis, University of Missouri, 1925. Also see O. Myking Mehus, "Have we Over-emphasized Heredity," *Journal of Education*, June 29, 1931, pp. 705-708.

of scientists on the basis of occupations of fathers, Professor Cattell found that the professional classes contributed, in proportion to their numbers, about four times as many scientists as did the nonprofessional groups.

Leadership in science according to Cattell appears to depend upon a social environment that supplies the proper stimulus and supplies it to the right degree.

On the other hand, the conclusions drawn by Woods, Dugdale, and Goddard would make the hereditary factor preponderant. Woods¹ made an exhaustive study of 832 representatives of the important families of European royalty. An analysis of his findings shows that from the total number of cases, twenty-five were world-geniuses. This led Woods to assert that the royal breed is superior to any other one family, but his analysis does not take into consideration other important factors.

Dugdale² made a study of a family infamous for generations on account of its contributions to crime, pauperism, disease, viciousness, and immorality. Of the 540 known members of this family, which he designated as the Jukes, he found that 310 had spent approximately a total of 2300 years in almshouses, 440 were physical wrecks, 130 were convicted criminals, and over half the women were immoral. Not a single member had ever held any office. Dugdale attributed the lot of this unfortunate family to the force of heredity. Estabrook, the author of "The Jukes in 1915," made an examination of Dugdale's data and of the environment in which the members were reared. His findings have led others to the assumption that environment (the lack of schooling, religious influence, and moral codes, and social prejudice against the Jukes) was an important

¹ F. A. Woods, *Mental and Moral Heredity in Royalty*. Henry Holt and Company, New York, 1906.

² R. L. Dugdale, *The Jukes*. G. P. Putnam's Sons, New York, 1910.

causative factor. Dugdale failed to note that immorality, intemperance, and crime are invariably attributable, at least in part, to social environment.

From an analysis of the Jukes family, Darrow¹ arrives at the conclusion that bad social conditions, not heredity, were the causative factors. He writes, "The Jukes story is the story of any number of other families environed as they were. Living in a sterile country, surrounded by poverty, condemned by conditions which have always been common to certain localities, they developed a manner of living and acquired a reputation which as social heritages were passed on from generation to generation."

Dugdale himself even found that the Jukes who left the home community became better citizens and that industrial changes resulted in the establishment of homes, greater privacies, and a higher moral tone. The status of the Jukes appears, therefore, to have been greatly influenced by their social environment.

One of the most fascinating stories of a family history was written by Goddard,² who at the time was psychologist at the Vineland, New Jersey, Training School for the Feeble-Minded. He made a study of the family history of one of the inmates, whom he called Deborah Kallikak. He was able to trace her ancestry back to a Martin Kallikak who had served in the American Revolution. Deborah was descended from Martin Kallikak and a feeble-minded girl to whom he was not married. All the descendants from Martin and his lawful wife were normal except two, but these were not feeble-minded. Of the 480 descendants by the feeble-minded woman, 262 were distinctly feeble-minded, according to Goddard. Furthermore, not one of

¹ Clarence Darrow, "The Edwardses and the Jukeses," *The American Mercury*, Vol. VI, No. 22 (October, 1925), pp. 147-157.

² H. H. Goddard, *The Kallikak Family*. The Macmillan Company, New York, 1916.

them possessed superior ability. Since the descendants by the lawful wife and by the feeble-minded girl were studied in many and varied environments, and the respective strains were true to type, Goddard concludes that "heredity has been the determining factor in the formation of their respective characters."

There is considerable ground for challenging Goddard's conclusions. It may be argued that there is no conclusive evidence that the barmaid with whom Martin Kallikak mated was feeble-minded. Moreover, the attitude of the public toward an unwed mother and an illegitimate child in those days may have been almost intolerable. Such an environment would lead to sex indulgences, intemperance, and association with others of the same or similar condition. A bad social environment would reduce the best of people to social-moral degeneracy and impairment of health. One member in the Kallikak family married and moved to a different environment. His descendants were good citizens. Even a daughter of a prostitute in the family turned out well after moving to a different community. In the absence of mental tests, drunkenness and sexual delinquencies cannot be used as indications of feeble-mindedness of the barmaid. As many valuable and relevant sociological, psychological, and medical data were unavailable to the investigator, Goddard's study cannot be said to be conclusive.

The results of the studies described on the foregoing pages, as well as a number of similar studies, would support the conclusion that both heredity and environment are factors which mutually in large measure determine the mental make-up of the individual. Genius may be inherent in many individuals, but it will not usually manifest itself unless a proper social and physical environment is provided for its stimulation and development.

We now turn to a number of important experimental and statistical studies of twins which bear significantly on our problem. Thorndike's study¹ is perhaps the best known of the earlier investigations in this field. Galton had collected data on twins by the questionnaire method, to which serious objections may be made. In 1905 Thorndike made objective measurements of 50 pairs of twins selected at random from the New York City public schools. Eight physical and six mental measurements were made. His results showed that heredity was the more potent factor, since twins showed greater resemblances than siblings, and resemblances of young twins were equal to resemblances of older twins. Thorndike concluded that "The nature of the germ cell causes whatever similarities or differences exist in the original natures of men, that these conditions affect mind and body equally, and that in life the differences in modifications of body and mind, produced by such differences as obtained between the environment of present-day New York public-school children, are slight." Sandiford² offers a better interpretation of the findings. He says:

The potential or hereditary traits of siblings, unlike twins, and like twins represent a series increasing in similarity. Under the influence of environment, these potential traits develop into a similar series of increasing likenesses. But environment causes slight differences to appear even when the heredities are identical as in those of twins.

One of the most extensive and best-controlled investigations bearing on the nature and nurture problem was the study of 1000 gifted children in California by Terman and his associates. Only children with an I.Q. of 140 or over (less than one half of one per cent of the school population)

¹ E. L. Thorndike, "Measurements of Twins," *Archives of Philosophy, Psychology, and Scientific Methods*, No. 1, 1905.

² Peter Sandiford, *Educational Psychology*, p. 42.

were used in the study. Information collected two years after the initial study showed that these children had maintained their marked superiority over their classmates. The basis for the higher achievements of these children is to be found primarily in their original nature.

Cox,¹ an associate of Terman, made some interesting genetic studies of genius. From a variety of biographical and autobiographical material, she attempted to determine the I.Q. of these individuals when they were children. While a study of this character is of doubtful reliability, the investigator found that great men develop predominantly from children who, from an early period, manifested unmistakable signs of superior intelligence. Take the case of Galton, one of the greatest men of the nineteenth century. Note the caliber of the letter that he wrote to his sister on the day before his fifth birthday.

My dear Adele:

I am four years old and I can read any English book. I can say all the Latin substantives and adjectives and active verbs besides 42 lines of Latin poetry. I can cast up any sum in addition and can multiply by 2, 3, 4, 5, 6, 7, 8, (9), 10, (11).

I can also say the pence table. I read French a little, and I know the clock.

Francis Galton

February 15, 1827.²

Jennings³ points out that our whole mental life and behavior are bound to be diverse with different environments. Human conduct, character, and personality are the outcome of interaction between nature and nurture, although they may be altered by changing one or the other. Muller

¹ Catherine M. Cox and others, *Genetic Studies of Genius*, Vol. II. Stanford University Press, 1926.

² Quoted from Karl Pearson, *Life, Letters, and Labors of Galton*.

³ H. S. Jennings, *The Biological Basis of Human Nature*. W. W. Norton & Company, New York, 1930.

and Newman found that while identical twins are, on the whole, very similar, they may become considerably different in temperament and mental reactions. Character is largely a matter of environment and education. Certainly, our appreciations, standards of value, and finer sentiments usually reflect the influence of environment and education. Our social institutions are a valuable part of our environment. Without this social heritage, man would be little better than the apes.

One of the most noteworthy studies in this field was made by Freeman. He studied the effects of the environment on the intelligence of foster children.¹ In this study, nature and nurture were in a measure dissociated, owing to the fact that foster children were introduced into an environment other than that which surrounds their natural parents. The effect of the foster-home environment was studied in various ways. A definite improvement in the intelligence-test rating was noted in the case of a small group for whom the test scores both before and after adoption were available. The resemblance between true siblings placed in different homes was found to be considerably less than when they lived in the same home, while the unrelated children who had been reared in the same foster home were found to have a greater resemblance in intelligence. A correlation of $.48 \pm .03$ for the group of 401 children was found between the intelligence of foster children and the grade of the foster home as it was determined by means of a home-rating score card. The group of foster children were above average in school achievement, and their general social-moral conduct was much better than that of their natural parents.

¹ F. N. Freeman, Karl J. Holzinger, and Blythe C. Mitchell, "The Influence of Environment on the Intelligence, School Achievement and Conduct of Foster Children," in *The Twenty-seventh Yearbook of the National Society for the Study of Education*, Part I, Chap. IX.

Freeman, Holzinger, and Newman¹ studied the resemblance in a variety of traits of fifty pairs of identical and fifty pairs of fraternal twins of the same sex. Physical, mental, and educational tests were administered. The identical twins were found to be much more alike than the fraternal twins. Moreover, some traits were found to be more subject to environmental influences than others.

Further studies of this character are reported in the Twenty-seventh Yearbook of the National Society for the Study of Education. One of these investigations by Freeman, Holzinger, and Mitchell bears out the hypothesis set forth above, that a significant improvement in intelligence (as measured by tests) results from improved environmental conditions, and that part of the resemblance between siblings brought up together is attributable to the influence of a similar environment. The child's intelligence is influenced to a marked degree by the character of the home.

In another study Burke² expresses the view that the relative effects of heredity and environment may be measured. She believes that this can be accomplished by controlling one of the variables (heredity or environment). On the doubtful assumption that this can be done, Burke concludes that approximately 17 per cent of the variability of intelligence is owing to differences in the home environment. This study, like many others, is open to certain obvious objections; it assumes, for example, that heredity and environment operate singly and that rating scales are absolutely valid.

In 1921 Cyril Burt³ reported that native intelligence, as

¹ The Twenty-seventh Yearbook of the National Society for the Study of Education, Chap. IX.

² B. S. Burke, "The Relative Influence of Nature and Nurture upon Mental Development," Twenty-seventh Yearbook of the National Society for the Study of Education, 1928.

³ Cyril Burt, *Mental and Scholastic Tests*, pp. 20 ff. London, 1921.

measured by the Binet tests, contributed 33 per cent to the complete score of adolescent children, that general experience or informal education of everyday life contributed 11 per cent, and that formal schooling contributed 54 per cent. Willard, testing adolescent children by two different series of the Terman group tests, found that schooling independent of native intelligence contributed approximately one half to the complete score.

Two additional studies of considerable importance bear on this general topic. W. C. Bagley¹ and H. B. Alexander² made analyses of the results obtained from the Army Intelligence Tests, which were administered to more than a million and a half drafted men during the World War. They checked these ratings by states against ratings of the efficiency of the public schools in these same states a generation ago as measured by the Ayres Scale. The aim was to determine whether the intelligence-test ratings were influenced by schooling.

Alexander ranked forty-one states according to the median scores made by their literate *white* troops on the Army Alpha Intelligence Test. Seven states were not included in the study because of the relatively small number of recruits from these states in the camps where the tests were administered. The correlation coefficient, expressing the degree of correspondence between the two rankings, — rank in intelligence and rank in school efficiency, — was found to be .72 with a probable error of .05.

Alexander came to the conclusion that "in so far as it applies to such large social groups as the American states, Army Alpha appears as a test of what *has been learned* rather than what *can be learned*."

¹ W. C. Bagley, "Do Good Schools Pay?" *Journal of the National Education Association*, June, 1923, pp. 211 ff.

² H. B. Alexander, in *School and Society*, Sept. 30, 1922.

TABLE I. COMPARISON OF 41 STATES AS TO MEDIAN SCORES MADE BY WHITE RECRUITS IN ARMY ALPHA, WITH THE RANKS OF THE SAME STATES IN SCHOOL EFFICIENCY IN 1900 (AYRES'S RATINGS)

For the 41 states: Correlation Coefficient is +.72; Probable Error, .05.

STATES	MEDIAN ALPHA SCORE	RANK IN INTEL- LIGENCE (1918)	RANK IN SCHOOL EFFICIENCY (AYRES, 1900)
Oregon	79.9	1	26
Washington	79.2	2	12
California	78.1	3	3
Connecticut	73.6	4	4
Idaho	73.5	5	29
Utah ¹	72.2	6	9
Massachusetts ¹	71.6	7	1
Colorado	69.7	8	6
Montana	68.5	9	8
Vermont ¹	67.5	10	18
Ohio ¹	67.3	11	10
Maine ¹	67.0	12	25
Nebraska	66.2	13	15
Pennsylvania ¹	65.1	14	13
New York ¹	64.5	15	2
Iowa ¹	64.4	16	21
Minnesota	64.0	17	19
Kansas	63.9	18	28
Illinois ¹	63.8	19	11
Michigan ¹	63.3	20	16
Rhode Island	62.9	21	5
New Hampshire ¹	61.9	22	24
Missouri ¹	59.5	23	27
South Dakota	58.3	24	23
North Dakota	57.1	25	20
Wisconsin ¹	56.5	26	22
Virginia ¹	56.3	27	34
Maryland ¹	56.2	28	17
Indiana ¹	56.1	29	14
Oklahoma	52.5	30	32
Texas ¹	50.9	31	31
New Jersey	48.7	32	7
South Carolina ¹	47.4	33	39
Tennessee ¹	47.2	34	33
Alabama ¹	46.3	35	40
Louisiana ¹	45.2	36	35
North Carolina ¹	43.2	37	41
Georgia ¹	42.2	38	36
Arkansas ¹	41.6	39	37
Kentucky ¹	41.5	40	30
Mississippi ¹	41.2	41	38

¹ For 26 states with 55 per cent or more of population native to state in 1910: Correlation Coefficient is +.818; Probable Error, .045.

Bagley reaches even stronger conclusions. A critical analysis of the data led him to the conclusion that a higher and a more reliable relationship is evidenced if only those states having a majority of population native to the state are considered. This affords the investigation better opportunity to show just what the influence of schooling has been. The conclusion reached was that the states which had good schools in 1900 made good records in the Army Tests in 1918 and the states that had poor schools in 1900 made poor records.

"The median Negro scores when distributed by states show a closer resemblance to school conditions in those states in 1900 than do the white scores," says Bagley. Further evidence is shown that intelligence-test results are profoundly influenced by school opportunities. An examination of the Army Beta Test records made by illiterate soldiers reveals that they show "a much lower correlation with school efficiency and with the other tests presumably affected by schooling than do the Alpha Tests."

The survey made of schools in the Philippine Islands reveals much the same results as the Alexander and Bagley studies. These Islands came into the possession of the United States in 1898. Immediately steps were taken to establish a system of public education. Little more than twenty years afterward tests were administered for the purpose of determining the general level of educational efficiency. These schools were very similar to the schools in several of our states which had low educational ratings. In both cases the schools were primarily rural or village. The teachers in both situations had approximately the same training. The test results were also about the same. This proves rather conclusively that educational opportunity is a force of considerable consequence, even when there are radical differences in race and in historical background.

Conclusions. The evidence presented in this chapter is not altogether consistent. The problem of the relative influence of innate and acquired intelligence is in a state of uncertainty, although certain conclusions are obvious. It is highly important that every individual be well born. It is likewise imperative that the best possible environment and educational opportunities be provided. Nature and nurture work together. Which one is the more important is an unanswerable question. Up to the moment that a new life is started, heredity is all-important; but after that moment, physical, social, or educational conditions are of primary consideration. Without a sound heredity the individual would very likely be defective in some respect, no matter what the environment; and if a child of sound heredity be placed in an environment isolated from all influences of social institutions (language, customs, etc.), there would be little or no mental development.

The individual is fundamentally a product of heredity and environment. Every physical feature and every mental trait depend upon the structure and organization of the individual and all the forces that are brought to bear on the individual, such as experience, education, health, and environment. The features and traits of the individual may be changed by changing the materials that make up the biological organism. They may be changed also by the conditions of life. No trait or characteristic is due exclusively to nature, and none exclusively to nurture. All, however, are the result of an interaction and interdependence of heredity and environment. All can be modified or altered by appropriate changes in either heredity or environment.

This point of view is well summarized by Child,¹ from whom we quote:

¹ Charles M. Child, *Physiological Foundation of Behavior*, pp. 30, 43-52. Henry Holt and Company, 1924.

The organism is primarily the reaction to environmental factors of a protoplasm with a certain hereditary constitution. The organism is inexplicable without environment. Every characteristic of it has some relation to environmental factors. And particularly to the organism as a whole—that is, the unity and order—the psychological differences, relations, and harmonies between its parts, are entirely meaningless except in relation to an external world.

Heredity does not account for the individual but merely for the potentialities, some of which are realized in the individual. . . . Behavior patterns constitute, for the time being, a new psychological integration, a new order and unity in the protoplasmic mass, and this new integration is determined, not by heredity, but arises as a reaction of the living protoplasm to environment factors.

In later chapters the modifying function of the individual's activities and learnings will be developed.

QUESTIONS

1. Distinguish between nature and nurture.

What is the nature-nurture controversy?

How do the Gestalt psychologists avoid the controversy?

2. What laws should be enacted for the purpose of effecting proper social control of persons who are biologically defective? Why?

3. What does Jennings mean when he compares the chance combination of genes to "the drawing of a lottery with the genes as the counters"?

4. What conclusions do you draw from the studies of identical and nonidentical twins?

5. Criticize the conclusions Goddard reached in his study of the Kallikak family.

6. Describe the behavior characteristics of a gifted child of five years.

7. What does the Army Alpha Intelligence Test measure? Give arguments to support your position.

8. Why should a teacher be interested in the problem of social inheritance?

9. How may a knowledge of eugenics be a help in the improvement of the human race?

10. What was Mendel's contribution to the science of genetics?

11. Define the following terms:

heredity	identical twin
social inheritance	sibling
nature	I.Q.
nurture	chromosomes
intelligence	genes

REFERENCES

- BAGLEY, W. C. *Educational Determinism*. Warwick and York, Baltimore, 1925.
- CALDWELL, OTIS W., SKINNER, C. E., and TIETZ, J. W. *Biological Foundations of Behavior*. Ginn and Company, Boston, 1931.
- CHILD, C. M. *Physiological Foundations of Behavior*. Henry Holt and Company, New York, 1924.
- COWDRY, EDMUND V. *Human Biology and Racial Welfare*. Paul B. Hoeber, Inc., New York, 1930.
- DAVENPORT, C. B. *Heredity in Relation to Eugenics*. Henry Holt and Company, New York, 1911.
- EAST, EDWARD M. *Biology in Human Affairs*. McGraw Hill Book Company, New York, Whittlesey House, 1931.
- JENNINGS, H. S. *Biological Basis of Human Nature*. W. W. Norton & Company, New York, 1930.
- SHULL, A. F. *Heredity*. McGraw Hill Book Company, New York, 1926.
- THORNDIKE, E. L. "Original Nature," *Educational Psychology*, Vol. I. Teachers College Bureau of Publications, New York, 1913.
- Nature and Nurture, *The Twenty-seventh Yearbook of the National Society for the Study of Education*. Public School Publishing Co., Bloomington, Ill., 1928.

CHAPTER IV

BIOLOGICAL FOUNDATIONS OF BEHAVIOR

Educational psychology, the study of human behavior, or activity, in educational situations, has for its aim the prediction and control of activity to the end that better teaching and more economical learning may result. The individual is a constantly changing organism. He is never the same at any two moments. The environment, physical and social, is likewise always changing, with the result that he is never confronted twice with the same situation. Even if we assume that the environmental situations do not change, it remains true that the individual's learning at one moment will influence subsequent learning so that identical behavior will not recur.

While all this is true, we are making rapid strides in the scientific study of behavior in educational situations; and although we cannot predict just what behavior will follow the presentation of any given situation, we are increasing the probability of making correct and prompt diagnoses and of following them with appropriate remedies. In fact, we are becoming better able to anticipate what responses will be made to certain situations, and what situations will produce desirable responses. The physician is able to cure relatively few of the many diseases which he is able to diagnose. There are many diseases that can be diagnosed at first sight; there are others that are not so easily recognized. But, being trained in this field, the physician knows where to find information bearing on the case, what other observations to make, and what to try next in the

way of treatment. If his medicines do not cure, his observations and experience suggest other measures. There will be some cases that baffle even the most skilled physicians; but in terms of statistical averages, the trained physician is far more efficient than the layman. In the same manner the student of educational psychology is a more efficient teacher and learner than the person who is ignorant of its facts and principles.

We must look for the ultimate explanation of behavior in terms of physical structure and organization. The term "physical" is being used in its broadest connotation to include all body fluids and chemical elements as well as the more easily detected tissues and organs, and to include all connections resulting from learning in response to environmental situations. We recognize the great part played in human behavior by social institutions as a part of environment.

In this chapter we are concerned with the physical basis of behavior, including the influence of heredity, the physiology of the sense organs, the muscles, and the two great coördinating and motivating mechanisms—the nervous system and the endocrine glands.

Every behavior pattern, or configuration, is initiated and executed by the physical organism. Perceiving, remembering, acting, and thinking are functions of a normal physical structure organized in complex patterns within the neuroglandular and neuromuscular tissues.

Energy stored in the body makes possible its many and varied forms of reaction. The organism always seeks to maintain a state of adjustment. When this equilibrium is disturbed or upset, the organism devises or creates a new way of responding. Learning is the acquisition of ways and means to meet new situations in such a way that the equilibrium of the organism may be restored. All forms of

organisms may be said to create new responses. All behavior, therefore, is actively adaptive.

When the organism behaves, it responds as a whole. The behaving organism, taken as a whole, is more than the sum of its parts. The whole organism is more or less remade by each response. Obviously no learning act can be considered from a single angle.

Learning results in changes in organization of connections. These connections, or deposits of experience, become part and parcel of the total structure, and as such they help to form the configuration or pattern that gives rise to subsequent behavior. If the learning is to function in life situations, it is necessary that the learner become integrated. In this manner the whole organism becomes more or less involved in each response. An act can be understood only in relation to the whole of behavior. The whole child is being changed. As we study the physiology of the muscles, or the endocrine glands, or the nervous system, or the sense organs, we must not forget that each of these mechanisms functions only as a part of the whole body.

SENSE ORGANS

The sense organs, or receptors, are "the gateways of the mind." Our primary knowledge of the outside world is acquired through the senses. The receptors do not function by themselves. A physical stimulus, light from this page of printed matter, for example, acts on the retina of the eye that is focused on the page. Then the liberated energy, nerve impulse, or *neurokyme*, is transmitted over the optic nerve to the optic thalami and thence to the visual area of the brain, which in turn is connected with all parts of the brain and the reacting system, or effectors. In this case, the response, which involves for the most part the gray matter of the brain and, to a lesser extent, the muscles of

the eye and the speech mechanism, is called *reading*. There could be no reading unless all the elements in the configuration were present. There must be a stimulus, a sense

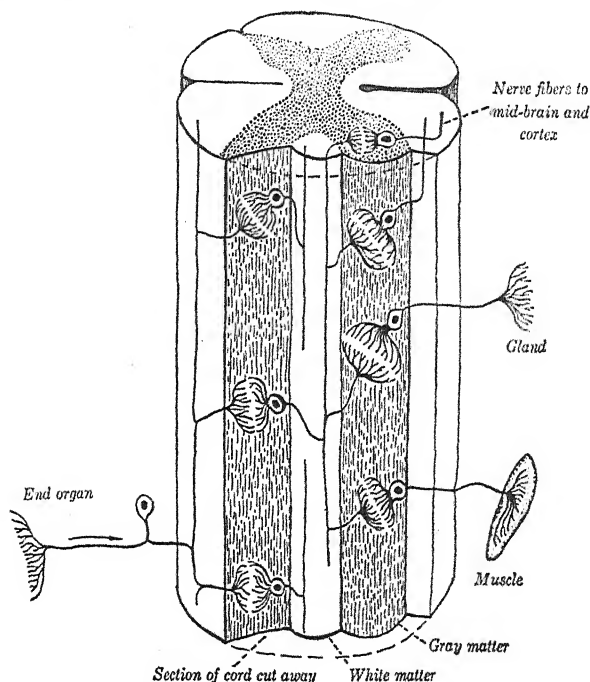


FIG. 1. Arrangement showing possible combinations of connections in the spinal cord

In reality the number of possible combinations is thousands, if not millions of times greater than shown in the diagram. The association, or connecting, neurones of the cortex of the brain give us the physiological basis of possible combinations and permutations of a higher level

organ, neurons, a nerve center, effectors (muscles, glands), deposits of previous experience, and purpose or mind set as to what is expected of the learner. The simple act of reading is a very complex process.

With this orientation in mind, we shall now turn to a detailed discussion of the sense organs and their functions.

The behavior of the child may be better predicted or controlled if the teacher has some knowledge of the physiological mechanisms underlying behavior. Each human being is a veritable dynamo. The energy of the learner may be said to be coexistent with life. It is distributed to various parts

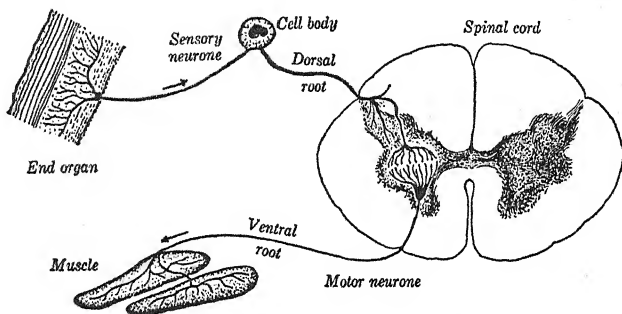


FIG. 2. The simple reflex arc

The nervous impulse is started in the sense organ. The arrows show the direction of the impulse

of the body and may be redistributed according to various principles of physiology, that is, "from regions of high pressure to regions of low pressure."

The sense organs, through which all primary information is received, are specialized body parts that are capable of specific nervous responses when stimulated by mechanical, chemical, or electrical stimuli. A ray of light, for example, "causes" the retina of the eye to release energy which is transmitted over the optic nerve to the optic thalami and thence to the cerebrum of the brain where a "consciousness of light" results. While many sensation responses involve discharges into the effector mechanism (muscles and glands), the brain is probably sufficient in itself for certain behavior responses.

The human being has many more than five senses, as is commonly believed. Each of these sense organs is highly specialized in structure, and each is sensitive to only one kind of stimuli. The eye is sensitive to "light" waves, and the ear to "sound" waves. Pain is experienced whenever any free nerve end is stimulated. The sense organs are not sensitive to all physical forces in existence. Rather they select specific stimuli within certain ranges or limits. The eye is insensitive to the infra-red and ultra-violet rays; the ear is insensitive to sound vibrations above and below a certain number per second.

The following kinds of sense organs are usually recognized :

1. Exteroceptors, or sense organs primarily distributed over the surface of the body and stimulated by changes in the external environment :
 - a. The auditory organs, the structures essential for hearing.
 - b. The visual organs, the structures essential for seeing.
 - c. The olfactory organs, the structures essential for smelling.
 - d. The four cutaneous senses of pressure, pain, warmth, and cold. The receptors for pain, warmth, and cold may be activated by stimuli originating from a distant source, but the stimuli must come in contact with them.
2. The proprioceptors, or sense organs lying between the outer surface of the body and the internal surface (that is, along the alimentary canal). These receptors are chiefly located in the semicircular canals of the ear (static sense) and in the muscles, tendons, and joints (the kinæsthetic, or "motor," sense). This class of receptors is activated by stimuli resulting from muscular and glandular activity of the body. The organs of equilibrium (static receptors) are involved in walking, running, jumping, skating, swimming, dancing, and other activities where equilibrium is necessary. The kinæsthetic organs are involved in all kinds of motor activities, such as writing, typing, boxing, using tools, and talking (vocal-motor). They function in such activities as walking, dancing, riding, and skating.

3. The interoceptors are the sense organs lying along the alimentary or food canal and are stimulated by the presence or absence of food and liquid, by chemical changes incident to digestion or decomposition of food, and by disorders or diseases of the tract. The gustatory receptors of taste in the tongue and receptors for thirst, nausea, hunger, temperature, and pain in the tract belong to this class.

The functions of the interoceptors (systemic senses) exert a profound influence, especially in the behavior of the young child. This is because these organs are so intimately involved in both health and emotional life.

It is through the normal functioning of the sense organs, the central nervous system, and the effectors that the child comes to know the social and physical world in which he lives. It is partly through his senses that he comes to know himself. From the same sources he finds situations to which he may respond, and it is through motor, glandular, and cortical responses that he grows and develops in body and mind. The brain would not develop normally if there were no incoming impulses from sense organs; intelligence would be nil, and consequently thinking, imagining, remembering, and acting would be impossible. In fact, all learning would be impossible. Indeed, it is certain that the human organism could not long exist if all the sense organs ceased to function, since the process of living is the adjustment of the inner activities of the organism to the environment. The sense organs are thus more than "gateways of the mind"; they are essential to life itself.

The experiences resulting from the functionings of the sense organs, in connection with the nervous system and effectors, are spoken of in psychological circles as sensations, or, more appropriately, perceptions, as these experiences take on meaning. The learner acquires the meanings from experience. Again, it is obvious that sensations and per-

ceptions do not come singly. The learner may be stimulated by the color of an apple, its size, shape, taste, and "feel" to the hands (touch and temperature) at one and the same time. In brief, this experience of an apple, or any other object, is a totality, a whole, with all its parts properly integrated with reference to each other and to the whole. Color is merely one aspect of the experience; taste, another aspect; and touch, still another aspect.

Soon after the birth of the child the sense organs manifest sensitivity. They start functioning naturally, provided that there are stimuli in the environment to which they may react. The eye would not be stimulated in a total absence of light, nor the taste organs in a total absence of food and liquids. A stimulus is essential. The sense organs are always in a state of readiness for use under favorable conditions, and their use normally results in general satisfyingness to the organism. This is just another way of saying that the child craves for and is satisfied by physical and mental activity. The character of the response to sense stimulation is determined by the nature of the organism itself. Just which response comes first and which second depends upon the order in which specific organs are stimulated and what the exciting stimulus is. The organism determines the kind of response that is possible, but the nature of the stimulus that is brought to bear on the organism determines whether the response is sound, color, sweetness, pain, or some other reaction. The function of the organs of stimulation is aptly expressed by Herrick¹:

Their function is to select from the infinite manifold of energy — manifestations by which the body is surrounded — those which have value for the body, and to sort these selected forms

¹ C. J. Herrick, *Neurological Foundations of Animal Behavior*, pp. 19, 43. Henry Holt and Company, 1924.

and so distribute them to the different correlation centers that they may be recombined and discharged to the motor centers requisite to give appropriate reactions.

Defects of the sense organs interfere with the clearness or accuracy of the impression. For this reason teachers aim at hygienic practices that will prevent the development of sensory defects. They should also be interested in the detection and correction of defects when they occur.

The chief auditory defects are some degree of general deafness, and specific deafness to certain sounds. Defects of the eye are the most common of all sensory disorders. Nearsightedness, farsightedness, astigmatism owing to defective curvature of the lens and cornea, and strabismus (squint-eyedness or cross-eyedness) are of most frequent occurrence. Color-blindness, nystagmus, and eyestrain are other common defects of the eye. There is no remedy for color-blindness, which is found in males much more frequently than in females. Nystagmus is a rapid, involuntary oscillation of the eyeballs. Eyestrain is a symptom which may result from myopia, hypermetropia, astigmatism, or strabismus. Not infrequently it is induced by a muscular weakness of the eyes, which in turn often results from an overfatigued or exhausted body.

The mind of the newborn infant is similar to that of the newborn animal in that it comes into the world without any experiences at its command save, possibly, a few and relatively unimportant sensations incident to its prenatal life. The fundamental difference is one of potentiality. The child is a creative organism. His sensory experiences, his "new and hitherto unimagined ideas," are developed or recombined into new patterns of experience. The human being is a creator and as such is free to act, think, and feel in new ways.

THE ORGANS OF RESPONSE

The sense organs would be of no service if there were no organs of response (effectors) to effect changes in behavior and in the environment that are biologically necessary to satisfy human needs. The receptors and effectors cannot function unless they are connected and the whole behavior unit or pattern properly integrated or adjusted. Integration is one of the functions of the nervous system. Many and varied responses are required in order to meet the biological needs of the learner. For the most part responses are selective and specialized. For reacting effectively to all kinds of neural impulses, liberated in some receptor or in the cortex of the brain itself, the learner is provided with muscles and glands. Some psychologists believe that the cortex of the brain is, at least in certain cases, an organ of response. Contractions of the muscles are required in effecting a movement of the body or any of its parts. Without muscles the individual could not learn to write, to skate, to walk, to dress or undress, or to talk. Secretions of certain glands are indispensable to both physical and mental development, to health, and to the meeting of certain emergency situations. Activity of certain muscles and glands provides a basis for much of human motivation, industry, and persistence. Some writers go so far as to interpret all human personality in terms of glandular secretions. Such interpretations are probably unreliable; but certainly some close connection between the two is indicated.

The human organism is so constituted that the muscles are in a state of readiness to respond when the proper stimulus is applied. The muscles of the hand and fingers of a young child are in a state of readiness to grasp. Grasping takes place when the child's palm is stimulated by contact with an object. The muscles of the eyelids are in

a state of readiness, and they act when an object is seen coming toward the face. The muscles of the arm will naturally react so as to withdraw the member if the fingers come into contact with a flame. The muscles of the hand and arm are in a state of readiness to manipulate objects if the organism has attained a sufficient stage of maturation. The vocal organs are ready to act. They respond when the proper stimulus is applied. The glands, in normal health, are likewise in a state of readiness to increase or decrease their secretions according to the needs of the body at the moment, upon presentation of the proper stimuli.

In addition to possessing a superior nervous system, man also possesses a superior vocal mechanism. The vocal organs make possible a variety of language responses vastly superior to those of all other animals. Man's vocal ability has enabled him to express himself in thousands of different ways understandable by others of his group. It has made possible the accumulation of a social inheritance and its transmission to succeeding generations. The free use of the hands is made possible by an erect posture. The development of the hand made possible the use of tools. The hand also served as a means of early communication by gesture. Later, use of the hand and arm in drawing and writing made possible an even greater development of social institutions and customs and their transmission to succeeding generations. Even man's ability to use the thumb in opposition to the fingers played no small part in his cultural development, for it facilitates the use of brush, crayon, and tools.

Wundt, Stout, Judd, Carr, and other psychologists have constantly emphasized the importance of language as a mode of response. Without this valuable tool, man's ability to reason, to imagine, or otherwise to behave intelli-

gently would be seriously limited and handicapped. Such social institutions as language enable the child to start with the end-products of the race. It is thus that he is able to acquire so much in so short a time. Without language and other related social institutions of modern society the child would be but little more advanced than the lower animals. Without them, learning would be almost zero, and religion and morality, as we know them, would be foreign to him. For these and other reasons our schools rightly place a great emphasis on language, reading, and literature.

CLASSIFICATION OF MUSCLES AND GLANDS

Some classification of muscles and glands will help the student to understand better the part they play in behavior. There are three kinds of muscles: (1) striated, striped, or skeletal; (2) smooth or unstriated; and (3) cardiac. The striated muscles, forming a considerable part of the body, are used in effecting movement of body parts. The smooth muscles are located primarily in the walls of the alimentary canal, the genital and urinary organs, the bronchia and diaphragm, the walls of arteries and veins, and other minor organs. The cardiac muscle, which has characteristics of both the skeletal and smooth muscle, is found in the heart.

Smooth muscles, although differing greatly in structure, react in much the same way as the striped muscles, and once they have reacted, they tend to hold for a longer time some degree of contraction. Such partial and persistent contraction is often spoken of as *tonicity* or *tonus*. The student who becomes so interested in his studies that he cannot relax when he retires is apparently suffering from *over-tonicity* of muscles. Tonus is a basis for motivation, or a "spring to action," providing as it does a condition of readiness.

Glands are of three kinds: (1) duct, (2) ductless, and (3) those that are a combination of both. The psychologist is concerned primarily with the ductless glands (endocrine), whose secretions (*autacoids*) are taken up by the blood as it flows through the gland. The chemical agents in such secretions are distributed through the body, where they effect certain coördinations or adjustments. Endocrinology, or the physiology of the endocrine glands, is an infant science. Much remains to be discovered. It will suffice here to point out certain functions that are commonly recognized.

There are two contrasting kinds of endocrine secretions. *Hormones* are autacoids that stimulate activity, whereas *chalones* tend to retard or slow down activity. These secretions thus stimulate or retard many body activities. The endocrine glands act as a system of checks and balances, rather than individually. One gland may inhibit the development of another gland until a certain stage of maturity is reached. Some promote physical growth, others affect brain or mental development, and still others are synchronized with sex development. Some are intimately bound up with body metabolism, and others with our mental and emotional life. The proper functioning of each and all is fundamental for both health and happiness.

The most significant of the endocrine glands for students of behavior are the thyroids, the parathyroids, the adrenal or suprarenal bodies, the pituitary body, the pineal body, the thymus, and the carotid body. The liver, pancreas, intestinal walls, sex glands (gonads), and several other glands, produce both internal (endocrinal) and external secretions, the latter being the products of duct glands.

The thyroid glands consist of two maroon-colored masses, one on each side of the windpipe, close to the larynx. The position of the glands is generally well known because of

the enlargement in the disease known as goiter. This gland secretes a powerful chemical called thyroxin, which contains about 60 per cent of iodine. Thyroxin plays an important rôle in body metabolism, mental and physical growth, and behavior at all ages. The thyroid is the master controller of the body metabolism. The thyroid and adrenals activate each other. The thyroid and pancreas check each other. Assimilation is accelerated and retarded by hormones and chalones. Of more importance to the student of human nature is the observation that a certain correlation exists between thyroid activity and human behavior.

The thyroid glands normally begin functioning some time before the birth of the child. This is very important from the standpoint of brain development. Nature determines that the human being will have approximately 10,000,000,000 neurones in the cortex of the brain. Practically all these cells are formed during the early months of embryonic life. Their growth is facilitated by normal activity of thyroid glands. Certain prenatal environmental disturbances may affect the functioning of the thyroids. Their malfunctioning may affect brain development, which is manifested later in mental retardation. When a child is born with a deficient thyroid gland, growth and development are arrested. The *cretin*, or child suffering from such a disorder, learns only with great effort and learns but little at that.

Thyroid deficiency in children, or cretinism, is easily recognized by the medical profession. It can be treated quite successfully by supplying the child with thyroid extract, but the treatment usually must continue throughout life. The treatment results in almost miraculous changes in body metabolism and behavior, in physical characteristics, and in ability to learn.

If the thyroid becomes overactive (hyperthyroidism), body processes are speeded up and the individual becomes

irritable, excitable, overactive, vivacious, and unable to relax or sleep well. The eyes bulge and the body loses weight. These disturbances are symptoms of the disease known as exophthalmic goiter (Graves disease), the ultimate cause of which is still a matter of conjecture. If the gland is sluggish (hypothyroidism), a disease known as myxoedema results. In these cases the body processes become sluggish, and the mental life is characterized by listlessness, dullness, indifference, lethargy. The body tends to become fatty or obese.

The sensitivity or irritability of nervous tissue is increased by thyroxin. Emotion-producing situations, in particular, render the brain cells more sensitive and hence more responsive. The transmission of neural impulses is facilitated. This more highly sensitive condition of nerve tissue in turn restimulates the thyroids and the adrenals. In this way the production of energy in the body is accelerated. In a sense the thyroids are the glands of emotion, since in strong emotions they seem to enlarge or become overactive and in cases of underfunctioning the emotional states become weak.

Embedded in each lobe of the thyroid tissue, or close to it, are two small bodies about the size of a wheat grain. These tiny structures, or parathyroids, four in all, provide some very important functions, for death follows their removal. Just what their functions are is not certain. There is evidence that they play a part in the control of toxic substances in the body. It is more certain that they check or restrain the nervous system from overactivity. They also seem to be involved in the control of calcium metabolism. Normal parathyroid functioning appears essential to mental health. Diseased or defective parathyroids appear to produce extreme depression, nervousness, restlessness, tremors, and sleeplessness.

The adrenal or suprarenal glands are two in number. They lie close to the upper part of the kidneys. They are like the parathyroid glands in that their removal results in death. The adrenal gland is really a double gland. The outside layer is called the cortex, and the central portion the medulla. (These terms are not to be confused with similar terms in connection with brain physiology.) Adrenin, or epinephrin, is the active element in the secretion of the medulla. Adrenin plays a part in the transformation of energy, by (1) controlling the amount of glycogen entering the blood from the liver; (2) producing a distention of the air sacs in the lungs; (3) increasing the oxidation processes in the muscles; (4) accelerating the rate of breathing; (5) neutralizing the fatigue-products in the blood resulting from activity; (6) constricting the blood vessels and thus furnishing the working muscle with a larger and faster blood stream, which adds to the food supply of the muscle and which dissolves and washes away the rapid accumulation of waste products.

When a person is emotionally excited, relatively large quantities of adrenin are poured into the blood. During strong emotional excitement, as in fear, rage, and pain, great and long-continued muscular effort is possible. There is evidence, however, that the adjustive response of the adrenals is dependent upon the brain. The emotion seems initiated in the cortex of the brain in response to some fear, rage, or other emotion-producing situation. The motor impulses are discharged along nerve fibers to muscles and to the adrenals, producing characteristic responses in these organs. The adrenal secretion, on the other hand, causes an increase in brain activity. There is thus a reciprocal relation between the brain cells and the adrenal glands.

The pituitary body or gland, about the size of a large pea, is situated immediately beneath the brain in a socket. It is

really a double gland, since each of the two lobes gives rise to a characteristic autacoid or possibly several autacoids, and each brings about a variety of effects. The secretion of the anterior lobe, *tethelin*, is the active element which helps to regulate the growth of the skeleton. This is especially evident when an oversecretion of this lobe produces an abnormal development of the entire body, known as gigantism and acromegaly; and an insufficient secretion causes retardation of body growth. *Pituitrin*, which is secreted by the posterior portion, produces a number of marked physiological responses of especial interest to the physician.

The pineal gland, also about the size of a pea, is embedded in the brain itself, just behind and above the pituitary. Disease of this gland in children is accompanied by an acceleration of the development of the sex organs. This gland is probably most active at the age of seven, after which it begins to atrophy. It is assumed by many endocrinologists that the secretions of this gland hold sex development in check until puberty. For this reason it has sometimes been referred to as "the gland of adolescence."

The thymus gland is located near the thyroid in the neck. From about eleven to fifteen years of age this gland increases in size and then grows smaller or even atrophies. It likewise is concerned with the function of the sex organs, probably checking their development.

The interstitial cells of the sex glands may produce an autacoid that accounts for the secondary sex characteristics, such as the change of voice in the boy in early adolescence and the growth of hair on the face. The hormone produced by the sex glands activates the entire sexual life in both sexes.

In all probability there are other glands which affect behavior in diverse ways; but because of the limitation of

our present knowledge and the belief that the ones discussed have the greatest influence on behavior, they will not be treated here.

The sense organs and the endocrine glands either originated from nerve tissue or are closely related in origin and characteristics to it. The sense organs and free nerve endings are sensitive to stimuli. Muscles and glands are responsive to motor discharges from nerve centers. Nerve fibers conduct or transmit nerve impulses. In man many of the sensory impulses are greatly modified in the brain before they are discharged into the muscles or glands. In the course of its journey through the myriads of cells and their branches, the impulse may be united with other sensory impulses (convergence) or it may be diffused into many muscles or glands (diffusion). Nerve tissue is also capable of serving as a storehouse for a great variety of modifications that tend to persist. Modifiability or plasticity means that the neural patterns are subject to change and that such modifications are retained more or less permanently. Learning, remembering, reasoning, and intelligence are possible because nerve tissue is modifiable.

Just what happens physiologically when habits are formed or when learning takes place, is a matter of conjecture. Notwithstanding certain objections made by Lashley and others, many hold that modifiability involves changes in synaptic resistance to neural impulses. According to this theory, learning weakens the natural resistance and makes subsequent passage of nerve impulses more certain, more prompt, and easier. Neural patterns which are expressed in overt or implicit behavior are thus established in the organism. The nerve elements become functionally linked together in varying degrees of complex patterns. The simplest conceivable pattern would involve at least two or three neurones. It is probable, however, that even

the simplest of actual patterns involve many hundreds, or even thousands, of neurones. In this way linkage permits of myriads of permutations and combinations of neural patterns, with the result that no normal individual ever exhausts his possibilities for learning.

Some of the neural connections are functionally present at birth, others are formed by the further maturing of the organism, and still others are acquired by experience. It is man's superiority in nerve organization that places him at the apex of all living animals.

THE NERVOUS SYSTEM AND BEHAVIOR

Man's superiority over other animals is primarily owing to his superior nervous system. His brain, for example, is relatively larger in size and is vastly superior in fineness of texture.

The nervous system is the great connecting system between sense organs and effectors. It is more than a connecting mechanism, as the connections or associations are integrative in character. It is the physical basis for all conscious activity and human learning. No thought, wish, or purpose exists independently of its action. In fact, that part of the nervous system known as the brain is often called the "master tissue" of the body, since it is the "seat of our conscious activities" and particularly because such activities enable it to exercise some measure of control over many phases of behavior.

The elementary structures of the nervous system are known as neurones. Each neurone consists of a unit of living matter called *protoplasm*. The neurone is made up of a cell body, which contains the nucleus, and outgrowths or processes, sometimes few and sometimes many in number. The processes that convey the impulses to the cell

bodies are called *dendrites*. The slender process which conveys the impulse away from the cell body is called an *axone*. It often has many side branches called *collaterals*. The axone is insulated with a fatty sheath, which is not present on the dendrites. There are many forms of neurones. Some have only a single process, as in the case of the sensory neurones, which connect sense organs with the spinal cord or mid-brain. The receiving end of the sensory neurones is a sense organ. The dendrites serve as receiving stations for the various nerve impulses. The impulses pass from a dendrite through a cell body along the axone and the collaterals. The junction of one neurone with another is called a *synapse*. Synapses are invariably found within the central nervous system; they may be found also in the ganglia of the autonomic system. The neural impulse thus passes from the cell body of the neurone along the axone to the dendrites of another neurone.

Neurones may be classified according to function as (1) sensory, (2) motor, and (3) connecting, or associating. The sensory neurones have their receiving ends in specialized sense organs. A motor neurone has its cell body in the brain or the cord, and the end plate of the axone in a reacting organ, a muscle or gland. The association neurones lie wholly within the cord and brain and connect the sensory or motor neurones with motor neurones. When one realizes that there are about 10,000,000,000 neurones in each human brain and that each neurone has many processes and hence many connections, one sees that the number of permutations and combinations is well beyond human imagination. Normally, nerve fibers have a one-way conduction. This means that a sensory neurone, which customarily conveys impulses from a sense organ to the brain or the cord, never conducts an impulse backward from the cord or the brain to the sense organ. The same is true of a motor neurone.

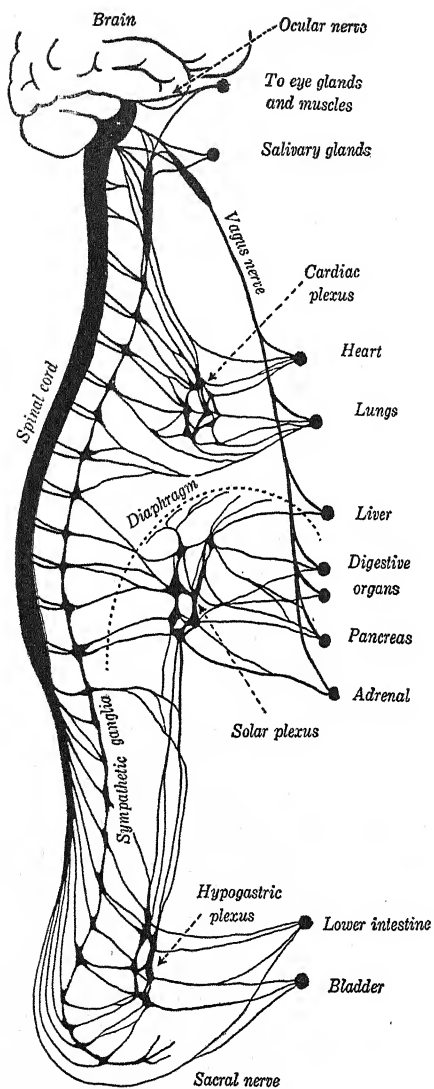


FIG. 3. The autonomic nervous system, showing some of the nerve connections

It never conveys impulses from the muscle or gland to the center. Sensory neurones have fibers originating in the accessory apparatus of the sense organs. Motor neurones have terminals in the reacting organs.

The cell bodies of the neurones are located in groups known as nerve centers. Extending from these centers are

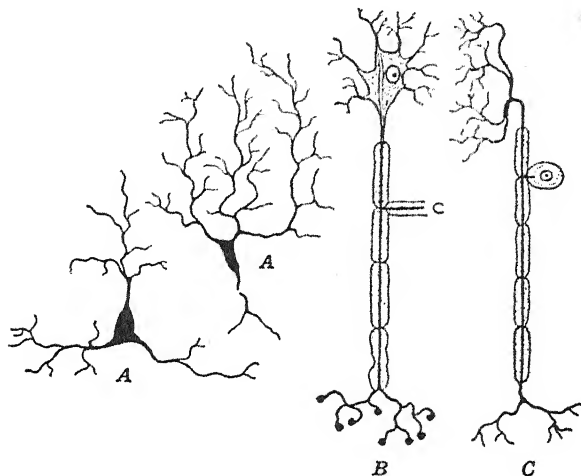


FIG. 4. Three types of neurones

AA, central neurones; B, motor neurone; C, sensory neurone
(After Burton-Opitz)

more or less elongated fibers of neurones, usually in groups or bundles called nerves. Nerve fibers do not always leave the nerve centers. Many extend from one part of a center to another part of the same center. In this way various areas are connected with one another by means of such fibers. This arrangement is splendidly illustrated in the cerebrum of the brain. The fibers passing from one part of the brain to another part are called association fibers.

There are two great divisions of nerve masses which

share between them the important functions of integration and control of behavior. The cerebrospinal division is primarily concerned with the adjustment of the organism to the outside world and to reality. This division is particularly responsible for conscious activities. The autonomic division plays an important rôle in regulating internal

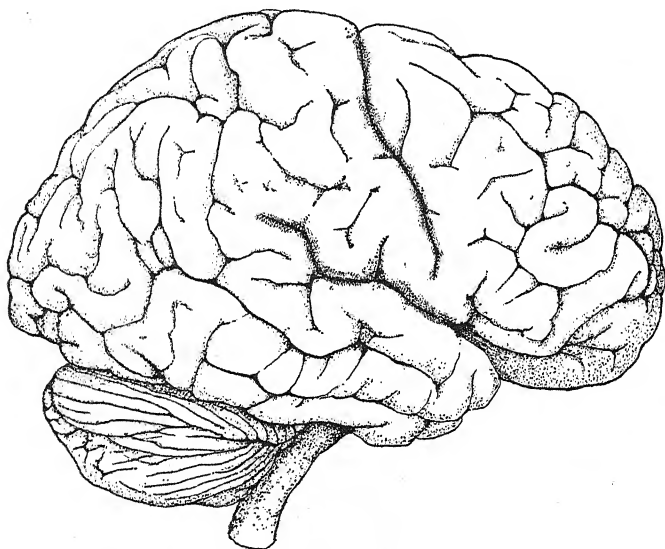


FIG. 5. Lateral view of adult human brain

reactions. Smooth muscles and glands are stimulated by impulses coming over neurones from the brain and cord to certain centers called ganglia and thence over other neurones to the smooth muscles or glands.

The cerebrospinal, or central nervous, division, as it is called, is composed of two relatively large and very complex centers or masses known as the brain and spinal cord. There are also included in this division the spinal and cranial nerves. The brain comprises five chief subdivisions:

the cerebrum, the cerebellum, the medulla, the thalami, and the pons Varolii. Discussions of the anatomy and the physiology of these nerve centers may be found in any good text in physiology. It must suffice to point out here some

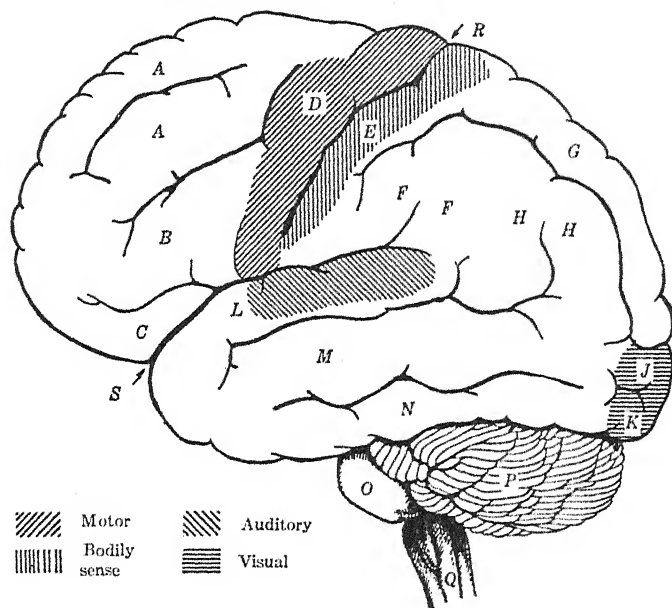


FIG. 6. Localization areas on the outer surface of the left hemisphere

Convolutions: AA, superior frontal; B, middle frontal; C, inferior frontal; D, precentral; E, postcentral; FF, supramarginal; G, superior parietal; HH, angular; J, superior occipital; K, inferior occipital; L, superior temporal; M, middle temporal; N, inferior temporal. *Other divisions:* O, pons; P, cerebellum; Q, cord; R, fissure of Rolando; S, fissure of Sylvius

of the more important functions of these masses for the student of behavior.

The cerebrum is the most conspicuous part of the human brain and is particularly associated with conscious activities, learning, and intelligence. The outermost layer, or

cortex, of the cerebrum consists of neurones. In the cortex are certain fairly defined areas which perform relatively specialized functions as either a sensory, a motor, or an association region. This means that certain fairly defined

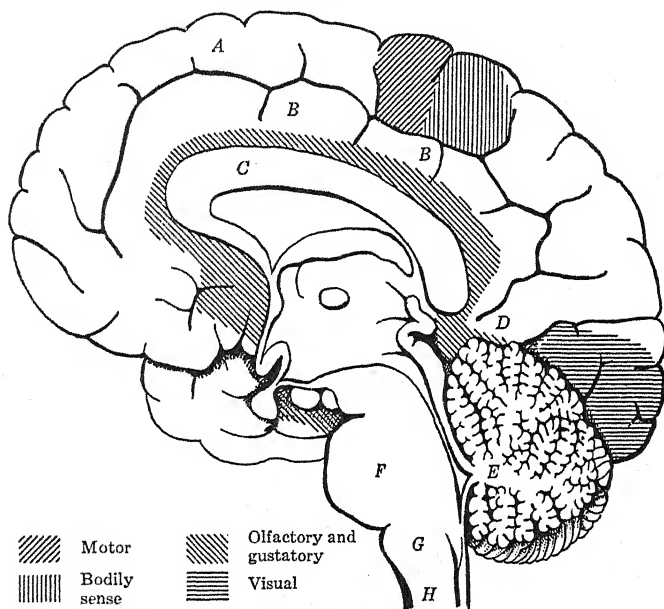


FIG. 7. Localization areas on the inner surface of the right hemisphere
Convulsions: A, marginal; BB, callosal. C, corpus callosum; D, isthmus;
 E, cerebellum; F, pons; G, medulla; H, cord

areas in the cortex receive the impulses originating in the sense organs, that other areas send impulses to muscles and glands, and that still others connect the several regions. It cannot be asserted that mental traits and learning are localized in any particular region as was done by the phrenologists who believed in mental faculties. Certain injuries to the brain have occurred without any apparent effect on

behavior. In other cases certain injuries have resulted in the loss of particular mental powers or abilities, but it has been shown that the individual may be reeducated. This indicates that other cerebral portions apparently take over

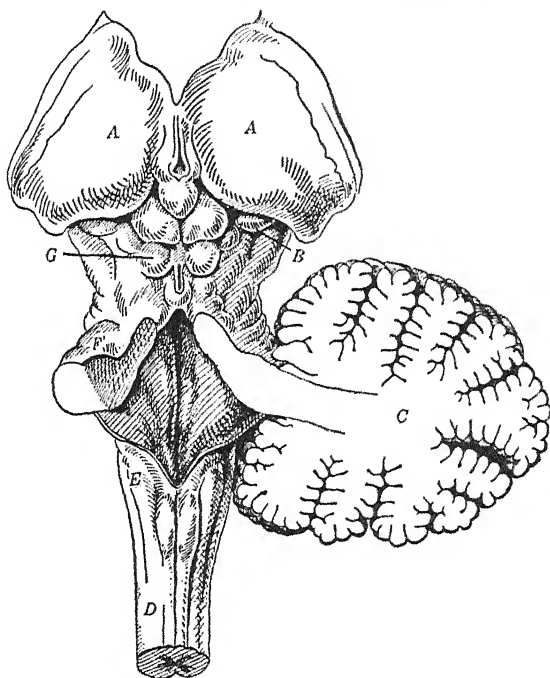


FIG. 8. The optic thalami viewed from the back, with the hemispheres and all but a portion of the right side of the cerebellum removed

A, optic thalami; *B*, geniculate bodies; *C*, cerebellum; *D*, spinal cord; *E*, medulla oblongata; *F*, pons Varolii; *G*, corpora quadrigemina

work that was formerly performed, in whole or more likely in part, by the injured or destroyed parts. All this tends to suggest that the brain is an organ that functions more or less as a whole.

In normal life, conscious reactions do not appear in iso-

lation from muscular and glandular reactions. These types of activity are combined and integrated in many ways and on different levels of complexity.

The cerebrum is often called the master organ of the body because it is not only the seat of all our perceptions, imaginings, rememberings, and reasonings; it is also concerned with our deliberations and choices.

The cerebellum is concerned mainly in the coördination of muscular movements, particularly such as are involved in making bodily movements and maintaining equilibrium or balance. This latter function is shared with the semi-circular canals of the ears, the retinas of the eyes, the cutaneous receptors, and the receptors in muscles and tendons.

The medulla is both an organ of conduction between the brain and cord and an important reflex center, controlling such vital bodily functions as breathing, the rate of the heart beat, the distribution of blood in the body, and the activity of the organs of respiration, as well as other somatic activities.

The thalamus is an important center for the relaying of certain impulses to the cerebrum. It is also thought to be associated with the feeling and emotional life of the individual, although the cerebrum and the autonomic division share this responsibility.

The pons Varolii is composed mostly of nerve fibers which connect the various parts of the brain.

ACTION OF THE NERVOUS SYSTEM AS A WHOLE

As was pointed out above, the psychologist is primarily interested in cortical structure and organization because conscious life is associated with the cortex. If our best present-day psychologists are correct, the cortex may initi-

ate nerve impulses through arousal of representations of previous experiences, or it may serve as a responding organ. The cortex, more or less like every other organ in the normal individual, operates as an integral part of the organism. It is now thought that every conscious reaction probably involves all the major parts of the brain. Every receptor is probably potentially if not actually connected with every effector or reactor. Owing to synaptic resistance at various points, nerve impulses aroused in any given receptor do not discharge into every effector in the body. The diffusion of nerve impulses, while far from being complete, does indicate that functional "pathways" may be established between all of the effectors.

On the other hand, impulses may converge from many receptors upon a single effector. Two or more kinds of stimuli may elicit a response, whereas a single stimulus would not do so. Nerve impulses from different parts of the body may so combine as to produce a movement, a thought, or an activity of a gland. It appears from this that nerve impulses from any or all receptors may so converge as materially to increase the probability of their reaching any particular effector. A muscle that flexes the finger, for example, may be activated by impulses coming from many and varied receptors in various parts of the body. The educational significance of diffusion and convergence is obvious.

Activity is said to be facilitated when simultaneous stimulations of several receptors, having the same or similar influence on common effectors, activate or reënforce each other so as to secure more prompt, definite, and vigorous reaction. The shouting of the crowd and the music of the bands at a football game may be said to facilitate the playing responses of the team. The track man runs faster when another runner is racing him "neck and neck" than when running

alone. The presence of the other runners facilitates his responses so they are more certain, prompt, and vigorous.

Inhibition is the phenomenon of partial or complete checking of nerve impulses or activities. A stimulus does not always facilitate action. Certain stimuli may partially inhibit a reaction. On the way to the dentist's office, the patient's thought of having a tooth extracted may inhibit the pain that was felt when he left his home. Inhibition is a form of reaction that results in the blocking of a response. It may cause either a reduction in, or a complete cessation of, activity or tonus.

Activity involves both inhibitions and facilitations. The teacher applies a stimulus here and a stimulus there for the purpose of facilitating pupil responses. She utilizes other techniques just as surely to inhibit certain responses of the aggressive and disobedient. The nervous system is peculiarly adapted for selecting, organizing, coördinating, and integrating nerve impulses and consequently for inducing behavior that is harmonious, intelligent, and unified. The phenomenon of integration may be illustrated by the trapeze performer in the circus. Every movement must be so finely adjusted, every part so finely coördinated and timed, that the act is perfectly unified. Normal conscious activity illustrates our point. The elements involved are integrated into a whole. That which is within the focus of consciousness is especially clear and unified. In fact, attention represents a high level of integration in normal life. Integration through coördination of facilitations and inhibitions is perhaps the most important action of the nervous system. It makes possible a unified and meaningful experience.

In contrast with the integrative action of the cerebrospinal division, the autonomic division, a component part of the nervous system, is primarily invested with the control of "internal" reactions, including the emotions.

The autonomic division comprises a chain of ganglia running the full length on each side of the spinal cord. These ganglia have connecting fibers to the cord and mid-brain, and neurones that extend to various plexuses in the body.

Grouped according to their location, the autonomic division has three main subdivisions:

1. The cranial section is connected with the mid-brain and upper part of the cord. These ganglia connect with the salivary glands, eye, heart, stomach, bronchi, liver, pancreas, spleen, and kidneys.

2. The thoracico-lumbar, or sympathetic, section is connected with the middle portion of the cord. Its neurones are widely distributed, extending to the eye, heart, arterioles, skin, viscera, and other body parts.

3. The sacral section, connected by ganglia with the lower part of the cord, is distributed to the colon, bladder, and genitals.

The function of the sympathetic, or thoracico-lumbar, section is always antagonistic to that of the cranial and sacral sections. The cranial, for example, contracts the pupil of the eye, the sympathetic dilates it; the sacral contracts the descending colon, and the thoracic relaxes it. This "reciprocal innervation," as it is called, is of great service to the body.

The sympathetic section has nerves which discharge into nearly all the smooth muscles and glands. Its influences are widespread, as may be observed in the case of emotion. Just as there are all degrees of emotion, so are there all degrees of sympathetic innervations.

The action of the autonomic section is of a reflex and automatic character, but it does not act independently of the cerebrospinal division. While not controlled to any large extent by the latter, it may be influenced by impulses

issuing therefrom. The activities of one or more autonomic sections may be influenced by certain stimuli; for example, one's heart beats faster at hearing a loud peal of thunder, or at its representatives in consciousness (concepts). Internal reactions are alterations or modifications of activities which are, as a rule, initiated elsewhere in the body.

Internal reactions are intimately associated with the emotions. Fear and anger inhibit the various digestive functions, such as peristalsis and glandular secretions. Nature appears thus to enable the organism to deal better with an emergency. Energy usually used in digestion is conserved. Strenuous muscular activity is facilitated. Moreover, anger produces other changes in physiological functioning. Practically every organ of the body enters the picture and plays its part by making available every bit of energy in the organism. The blood is driven from the digestive organs, heart action is increased, blood pressure is heightened, circulation speeds up, breathing becomes deeper, oxidation is increased, elimination through skin and lungs becomes more rapid. The adrenal glands are activated by sympathetic fibers. The adrenin produced is placed in the service of the body. It contributes to profound changes in the organism by activating the brain cells, stimulating the liver in releasing its store of glycogen, speeding up assimilation of oxygen, hastening elimination of the products of fatigue, accelerating circulation and respiration, and increasing sensitivity of muscle fibers to nerve impulses. In other ways adrenin protects the organism by enabling it to deal economically with emergency situations. After an emergency passes, however, one is sure to experience a period of temporary inefficiency until a readjustment is made.

QUESTIONS

1. Why is it impossible to predict human behavior with perfect accuracy?

2. Responses are made to stimuli or situations. Should an individual's acquisition of learning be considered as stimuli in subsequent learning situations? Why or why not?

3. What are the "deposits" of experience in terms of physiology?

4. How many different senses are found in man? What are they?

5. What are exteroceptors, proprioceptors, and interoceptors? Of what value is such a classification of sense organs?

6. What are the chief defects common to the organs of vision?

7. What are the organs of response?

8. What are autacoids? Make a list of six autacoids and specify the physiological and psychological effects produced by each.

9. Sometimes the abnormal functioning of a gland of internal secretion produces abnormalities in behavior and body growth. Cite specific cases from your own observations or from your readings.

10. What is the physiology of the emotions?

11. How does a knowledge of neurology aid the student in his interpretation of behavior?

12. A critic has recently said that little more is known today about the physiology of learning than in the days of Descartes. Just what did this critic have in mind when he made the statement?

13. Distinguish between the cerebrospinal and the autonomic nervous systems. Do these divisions function independently of each other?

14. Describe the structure of the cortex.

15. Explain the statement "The nervous system functions as a whole."

16. What functions are performed by each of the subdivisions of the cerebrospinal and autonomic nervous systems?
17. Cite evidence to show that abnormal behavior is often closely correlated with abnormalities of the nervous system.
18. Discuss the hygiene of the nervous system.

REFERENCES

- CALDWELL, OTIS, W., SKINNER, C. E., and TIETZ, J. W. Biological Foundations of Education. Ginn and Company, Boston, 1930.
- CRILE, G. W. Man, An Adaptive Mechanism. The Macmillan Company, New York, 1916.
- HERRICK, C. J. The Thinking Machine. University of Chicago Press, 1929.
- HARROW, B. Glands in Health and Disease. E. P. Dutton & Co., New York, 1922.
- KRETSCHMER, E. Physique and Character. Harcourt, Brace and Company, New York, 1925.
- LASHLEY, K. S. Brain Mechanism and Intelligence. University of Chicago Press, 1929.
- TILNEY, F., and RILEY, H. A. The Form and Functions of the Central Nervous System. Paul B. Hoeber, New York, 1921.
- WHEELER, R. H., and PERKINS, F. T. Principles of Mental Development. Thomas Y. Crowell Company, New York, 1932.

CHAPTER V

GROWTH AND DEVELOPMENT

"The development of a human being, of a personality, from a germ cell," writes Conklin,¹ "is the climax of all wonders — greater even than that involved in the evolution of a species or in the making of a world."

In this chapter we shall discuss some of the more significant aspects of the growth of human beings. Mental and social-moral development will be discussed later. The child is a living, functioning organism. His home relationships, school problems, and behavior in general are very largely conditioned by his body structure and organization. Parents and teachers need to know a great deal about the physical and psychological implications of growth and development in order to understand and to teach the child. A knowledge of the child's level of physical development aids the teacher in placing the child in the proper grade, in assigning the proper amount of work, in providing suitable schoolroom equipment, and in directing his activities. The study of child psychology reveals certain general laws or tendencies of physical, mental, and social development in human beings.

*Growth and development.*² "Growth" is a term used to denote increase in size. It implies an actual quantitative change attributable to increase in the number of cells or the size of the cells. Development is qualitative. It denotes a

¹ Conklin, *Heredity and Environment*. Second Edition, 1917.

² For Hollingsworth development includes "all changes which occur to constitute the life-history of the individual"; for him growth is but a form of development. (H. L. Hollingsworth, *Mental Growth and Decline*.)

change in organization or function. Along with a growth in size, the child acquires knowledge and habits which enable him to adjust himself more effectively. Thus development refers to the formation of new coördinations and integrations and signifies progressive changes. Growth is primarily a matter of structure; development, of function. However, both terms are closely associated and very often are used interchangeably. Growth and development often take place at the same time, although growth generally precedes development. Nerve cells, for example, must attain a certain degree of maturity before development can take place. That is, mental development must wait until the brain cells have grown sufficiently in size to function. Nerve cells develop from use, whereas protracted periods of disuse tend to produce atrophy or an arrest of development.

THE NATURE OF PHYSICAL GROWTH

As was noted above, the child in normal health increases very rapidly in size or magnitude. A child, however, is not a miniature adult. The size and different parts of a child's body are not in the same proportion to each other as are the same parts in an adult. It is this difference in proportion as well as the difference in size that distinguishes the child's body from that of an adult. The head of the newborn infant is enormous in comparison with that of the adult in relation to the size of their bodies. In a two-months-old human embryo the head is approximately one half of the total stature; at birth, it is approximately one quarter; and at twenty years of age, but one eighth. In contrast to the infant's large head, his lower limbs are comparatively short and small.

Growth and development are not only concerned with

changes in size and body proportions; new features are acquired, and established features are often reduced or lost. The thymus gland, having served its purpose, usually atrophies by the time of maturity. The grasping reflex, which is present in newborn infants, usually disappears by the fourth month. The temporary teeth are lost to make way for the more permanent set. New characteristics are especially noticeable at about thirteen to fifteen with the onset of adolescence. In boys the beard begins to grow and the voice to change. The development and functioning of the organs of reproduction become more pronounced.

FACTORS INFLUENCING GROWTH AND DEVELOPMENT

Naturally, growth and development are influenced by heredity and a number of environmental factors, some of which are under our control. In the first place, heredity determines in a general way the size and form of the individual as well as the particular features, provided there is normal functioning of endocrine glands and a suitable environment for development.

Growth and development are very intimately conditioned by nutrition. The lack of the essential vitamins and minerals in foods affects growth and development adversely. Children reared under poor economic and social conditions are invariably shorter in stature and lighter in weight than children reared in a more wholesome environment. Certain diseases, such as scurvy, are known to be caused by vitamin insufficiency. A lack of iodine in water and food often results in goiter. Glandular disturbances owing to environmental or nutritional causes may result in various mental and physical anomalies.

Suitable and varied activities and adequate periods of rest are potent forces in normal development. No child

grows normally without exercise. If an arm is bound to the chest, the muscles will atrophy in the course of time. If a child loses his eyesight soon after birth, the visual area of the cortex of the brain does not develop normally. Suitable activities of various kinds are necessary in order to develop various parts of the body. The body needs rest and sleep in order to build up what has been depleted through exercise.

Growth and development are influenced by the state of health. Acute and protracted chronic infections are severe impediments. Good health is an excellent insurance of normal development. Growth is also conditioned by other factors such as climate, the physical environment, the social and economic conditions, sex, and age. Minor influences affecting the rate of physical growth and development include the time of year, the time of week, the time of day, and possibly the order of birth.

The rate of growth markedly decreases as the child grows older. The rate of growth is much greater during the prenatal period. The child at birth weighs about one thousand million times the weight of the fertilized ovum.

Men normally attain full height at the age of twenty-five and women at the age of twenty-three. Growth in weight may continue for some years longer, although pronounced changes after thirty are usually abnormal in character.

LAWS OF PHYSICAL GROWTH AND DEVELOPMENT

The development of the child shows certain characteristics that are normally applicable to all children. Heredity sets the limits of development and determines the direction, but environmental factors influence this course to a marked degree.

Physical growth and development is, on the whole, continuous, orderly, and progressive. The so-called stages are more or less artificial in nature. They merely serve the purpose of calling attention to outstanding features.

Various features or body parts grow and develop at different rates. As a rule, physical growth proceeds at the pace at which it began. From birth until the age of five, girls and boys grow at about the same rate. As a rule, the boys are a little heavier and slightly taller. From five to ten, boys appear to grow slightly more rapidly than girls, and from ten to fifteen the girls grow more rapidly than boys. From about eleven and one half to about fourteen and one half, they are actually taller; and from twelve and one half to fifteen and one half, they are heavier than boys. This difference may be because girls appear to have their adolescent spurt from one to three years earlier than boys. From fifteen on, the boys take the lead, arriving at full maturity at about twenty-five. The girls attain this stage at about twenty-three.

When physical growth and development curves show interruptions or spurts, such irregularities may be attributed to glandular disturbances, diseases, or environmental causes. If a child is poorly developed in some of his body parts or functions, he is generally poorly developed in others.

METHODS OF DETERMINING PHYSICAL DEVELOPMENT

For many years height, weight, and other physical measurements of children of different ages and grades have been made. It is only recently, however, that such measurements have been regularly made of the same children over a given period of years. The former method yielded growth norms of small predictive value. The latter gives us individual growth curves.

The child's growth in weight and height is probably one of the best single indices of his physical condition. It is also the most practical index to use. Weight-height tables may be misused by the untrained. While they are suggestive regarding the child's health, nutrition, and normal development, they do not furnish an infallible index applicable to all children. If a child's height or weight ratio is below what it should be for a given age, his parents and teachers should carefully check over the child's condition for an explanation.

ANATOMICAL AND PHYSIOLOGICAL AGES

In addition to having a chronological and a mental age, a child has an *anatomical age* (the stage reached in growth of structure) and a *physiological age* (the stage reached in bodily functions). The progress of growth or development in either of these respects can be represented by a quotient, the chronological age being used as a basis. The anatomical quotient is found by dividing the anatomical age by the chronological age; and the physiological quotient, by dividing the physiological age by the chronological age. Terms like "ages" and "quotients" make comparisons possible. They show how any given child compares with the average norm of children, not how a child compares with what he should be.

The anatomical age of any child denotes his degree of physical growth in comparison with the average of a large group of children of the same chronological age. This age is naturally variable, as a child's growth depends upon a large number of factors. Different authorities use different indices in the calculation of the anatomical age. The eruption of the teeth, the onset of puberty, and the degree of the development of the skeleton are indices that are commonly used to denote the level of growth.

From one year of age until twelve the presence or absence of certain teeth is fairly indicative of the child's stage of growth. For example, children generally cut the first tooth during the first year, and the first molar (belonging to the second set) at six years of age.

Ossification of the wrist bones is considered as one of the best methods of determining the anatomical age, as it is an index of skeletal development. The eight small bones in the wrist — known as the carpal bones — develop from cartilage into bone during childhood. This change begins in the first year of life and lasts into the eleventh year. At the same time ossification takes place in the bones of the forearm. The different stages of development of these various bones provide the various scales of anatomical ages. The degree of ossification is determined by the use of X-ray photographs and their interpretation.

The onset of puberty — that is, the age at which the individual becomes sufficiently mature to be a parent — is indicative of the degree of physiological development.

The anatomical and physiological ages are of importance to parents for the following reasons :

1. The height-weight index for the different ages is one of our best single indices of the child's general health.

2. The mental age is affected by physiological development.

3. Physiological development is fairly closely associated with moral development.

4. School progress is somewhat influenced by the degree of anatomical growth and physiological development.

5. Physiological and anatomical ages are useful aids in the classification of children and in determining types of activities suitable for them.

6. Mental retardation is not infrequently associated with retardation in physical growth and development.

THE RELATION OF PHYSICAL DEVELOPMENT TO
MENTAL DEVELOPMENT

Some relation exists between mental and physical development, as has been indicated. The evidence, while extensive, is somewhat inconclusive and confusing. Gates ¹ reviewed the investigations bearing on this problem which were made in the United States from 1892 to 1923. On the whole, this survey revealed that little relationship exists between the two variables.

Naccarati and Lewy-Guinsberg ² express the opinion that "the same hormones which promote the morphogenesis of the skeleton and muscles of the limbs, promote also the development of the psychomotor and psychosensory centers, and would lead to the conclusion that there exists a correlation between the morphological development and the intelligence of the individual."

Rotch ³ found evidence that "where there is delayed development, the development of the epiphyses and carpal bones corresponds more to that of the brain than to that of the general physical condition."

Woodrow ⁴ found that mental ability varies with physiological age and that the degree of brightness corresponds with the degree of physical development.

Baldwin, ⁵ who conducted one of the most extensive of investigations in this field, offers the following conclusions:

Physiological age is directly correlated with stages of mental maturation. The larger and physiologically more mature child may be able to do certain types of school work better although of inferior ability in specific traits which have been greatly empha-

¹ A. I. Gates, in *Teachers College Record*, Vol. XXV, pp. 229 ff.

² In *Journal of Applied Psychology*, Vol. VI, pp. 221-234.

³ In *American Physical Education Review*, Vol. XV, pp. 396-420.

⁴ *Brightness and Dullness in Children*, pp. 117-118.

⁵ *Physical Growth, from Birth to Maturity*, p. 196.

sized by the school curriculum. No child should be promoted or demoted without taking into consideration his or her physiological age. Girls may be expected to progress more rapidly than boys.

More recent investigations show little or no significant relationship between physical and mental development. The correlations found by Abernethy,¹ while positive, were rather insignificant.

Freeman and Carter² studied the relationship between the ratios of ossification, of carpal bones, and mental ages. The correlation found was practically zero. This is very significant when we consider the fact that the ossification ratio is probably the best single measure we have of physiological maturity. The chronological age is a slightly better index of the mental age than is the ossification index.

Gates³ made a study of the relation between ossification and height, weight, grip, lung capacity, chest, girth, nutrition, mental age, and educational achievement. Only a low positive correlation was found.

Results similar to those of Freeman, Carter, Abernethy, and Gates have been found by Brooks,⁴ who studied the relationship between mental or educational maturity and physical development in more than 1100 adolescents and found a very low positive correlation.

From these studies it is obvious that mental and scholastic maturity cannot be predicted satisfactorily on the basis of physical maturity, since measures of physical growth correlate so slightly with mental traits. Although a knowledge of the individual's degree of physical development is of value for other reasons, physical traits alone do not afford a basic criterion for the sectioning of classes or for the pro-

¹ Abernethy and Gates, in *Journal of Educational Psychology*, Vol. XVI (1925), pp. 458-466, 539-546.

² *Journal of Educational Psychology*, Vol. XV, pp. 257-270.

³ *Ibid.* pp. 329-358.

⁴ From *The Journal of Applied Psychology*, Vol. XII, pp. 228-241.

motion or demotion of pupils. A knowledge of the physical condition of the student is valuable when it comes to problems of instruction, guidance, and control.

STAGES OF HUMAN DEVELOPMENT

From the beginning of each new life at the moment of conception until death normal growth and development are a continuous, orderly, and gradual process. Where this is not the case, the cause is usually found to be some extrinsic factor rather than an intrinsic factor. In order to bring certain features within focus of the attention, it is customary to speak of stages of human development in which the later stage gradually or sometimes suddenly emerges from the preceding stage. No two authorities make the same classification, but in general all agree that the chief stages are the following:

1. The prenatal, which includes the period between the moment of the fertilization of the ovum and the birth.
2. Infancy birth to 1 yr. of age
3. Babyhood age 1 to 5 (pre-school)
4. Childhood age 5 to 12 (elementary)
5. Puberty . . . (transition period) age 12 to 14 (junior high)
6. Early adolescence age 14 to 18 (senior high)
7. Late adolescence age 18 to 23 (college)
8. Maturity age 23 to the onset of senility
9. Senility the period of old age, enfeeblement, beginning in some individuals at 60, in others at 70, and in still others not before 80 or even later.

The limits of the stages are not definitely defined, since physiological development is influenced by many factors. There are also great individual variations in any group having the same ancestors, social life, climate, and general health.

THE PRENATAL PERIOD

This begins with the event of conception when the male and female elements unite to form the new life. These elements are subject to certain influences before the moment of their union. If either parent has had an infectious disease such as Asiatic cholera or syphilis, or irradiation or X rays of the gonads, before conception, the mental capacity of the child may be seriously impaired. Toxæmias during pregnancy have also been shown to produce brain defects, which result in mental aberrations. Toxins from such diseases as pyorrhea, infected tonsils, and an inadequate or unbalanced diet, may so injure the glands of internal secretion in the pregnant mother that her baby will be a defective in body and in mind. In brief, the evidence from many investigations strongly suggests "that destructive, poisonous substances — if sufficiently intense, virulent, or long continued — may modify and injure the soma (body) and the germ plasm of the parents and of the embryo and fetus, either through the direct or indirect action of the toxins, thereby producing neuronic (nerve) arrest or degeneration and mental abnormalities; and that the modifications thus produced may be transmitted to the progeny for one or more generations."¹

In the prenatal period the child grows from a single-celled structure to an elaborate and highly complex organism. The nervous structure and organization, beginning within two weeks after conception, proceed at a rapid rate. In the second month many of the nervous elements appear as nerve cells without their typical extensions. During the third month they begin to send out threadlike prolongations, which in a few months connect all parts of the

¹ J. E. Wallin, "Studies of Mental Defects and Handicaps," *Miami University Bulletin*, Series XXII, No. 5 (January, 1924), pp. 123-124. Oxford, Ohio.

organism into an elaborate system. By the fifth month practically all the neurones that the individual will ever possess have been formed. As the nervous system develops, the cell bodies become more elaborate both in structure and in organization. Moreover, the axone processes acquire a covering, or *myelin sheath*. It is the organization of processes, so that the neurones may come into ready communication with others, and the sheathing of the nerve processes that makes possible not only the functional activity of the nervous system but also paths and systems of ready conduction. Some of the neural patterns are perfected by birth, some much earlier, and still others not until later. The earliest systems to mature are those that are most fundamental for the organism's existence.

THE NEWBORN CHILD

At birth the infant is a clumsy, helpless creature. Not infrequently the head is poorly shaped. He makes awkward movements and cries loudly. Most of his time is spent sleeping. Experiments made with very young infants show that the sense organs are usually ready to respond to their characteristic stimuli. Hearing may be somewhat delayed, owing to the presence of amniotic fluid in the ear cavities. The sense of sight is probably vague, owing to the immature development of the rods and cones of the fovea in the retina.

At birth the child possesses reflexes of various kinds. The following either are present or develop within a few days after birth:

Breathing	Patellar reflex	Swallowing
Digestive reflexes	Heart action	Hiccoughing
Excretion	Eye movements to light	Yawning
Pupillary reflex	Sneezing	Sucking

In addition, there are a large number of other movements which become quickly established, such as squirming, slashing movements with the limbs, opening and closing the mouth, moving the fingers and toes, clenching the fist, lifting the head slightly, and moving the head sidewise. The formation of habits begins at once. New stimuli produce reactions that were evoked previously by other stimuli, and new responses are evoked by old stimuli. In this way the original repertoire of reflexes and instinct-tendencies becomes enlarged by the making of new responses to new stimuli (conditioning).

At birth the child is able to support its own weight by grasping the finger of an adult. By the fourth month this reflex generally disappears. In a few months the child learns to creep, and at about one year of age to walk. Many other coördinations are being acquired, one of the most important being the coördination of the eyes. Voluntary control gradually emerges from the involuntary and more or less random responses.

Infancy gradually merges into babyhood. By the age of three years the brain has attained about seven ninths of its adult weight. The senses are more acute and motor coördination is better established. By five or six the average child is sufficiently developed to profit by approved school activities. Growth and development continue throughout childhood without any unusual events of note. However, during the period of puberty, or transition, and adolescence the child experiences more striking changes. Not infrequently physical growth appears to be considerably accelerated. The whole psychic life is often expanded. A feeling of a new sense of power and importance replaces the feeling of dependence which characterizes the younger child. An interest in others, often of the opposite sex, replaces the self-centered attitude of the younger child. Self-

ishness often gives way to altruism. Group interests and coöperation frequently supplement or supplant individual interests and activities. From adolescence emerges the mature man or woman.

QUESTIONS

1. Distinguish between growth and development.
2. What factors influence growth and development? Cite evidences from your own observation in support of the author's statements.
3. What are the chief laws of physical growth and development? Which of these characteristics have you observed?
4. What relationship exists between physical development and behavior? What experimental evidence have we on this subject? To what extent is the relationship significant?
5. What is meant by physiological and anatomical ages? How is each age determined?
6. Describe the development of nervous structures in the child during the embryonic period.
7. Describe the behavior of a newborn child.

REFERENCES

- BOLTON, F. E. *Adolescent Education*. The Macmillan Company, New York, 1931.
- CALDWELL, O. W., SKINNER, C. E., and TIETZ, J. W. *Biological Foundations of Education*, Chap. xxvii. Ginn and Company, Boston, 1931.
- CURTI, MARGARET WOOSTER. *Child Psychology*, Chap. iii. Longmans, Green & Co., New York, 1931.
- HOLLINGWORTH, HARRY L. *Mental Growth and Decline, A Survey of Developmental Psychology*. D. Appleton and Company, New York, 1927.
- JOHNSON, BUFORD. *Mental Growth of Children in Relation to the Rate of Growth in Bodily Development*. E. P. Dutton & Co., New York, 1925.
- PECKSTEIN, L. A., and MCGREGOR, A. L. *The Psychology of the Junior High School Pupil*. Houghton Mifflin Company, Boston, 1924.
- WOODROW, HERBERT. *Brightness and Dullness in Children*. J. B. Lippincott Company, Philadelphia, 1923.

CHAPTER VI

THE DYNAMICS OF BEHAVIOR

Dynamic psychology, motivistic psychology, and Gestalt psychology, like the older self-psychology, or hormic-psychology, place the emphasis not on the stimulus or the response but on the living dynamic organism, that is, the dynamic forces behind all responses. Mental activity originates in the individual organism, not in the environment.¹ All activities, physiological and mental, have their origin in the life impulses, energies, and aspirations of the living organism. The stimulus plays a secondary rôle as the exciting cause. The organism determines the nature of the response.

Thurstone² expresses this point of view:

In the last analysis the datum for psychology is the dynamic living self and the energy groups into which it may be divided. We may refer to this datum as the Will-to-Live, or we may call it the Life-impulse, or the Vitality of the organism, or we may discover it to be the energy released by metabolism. We may be able to subdivide our will to live into large energy-groups which manifest themselves in conduct more or less independently. These energy groups would be our innate, dynamic, and more or less distinct sources of conduct, and we might come to call them drives, motives, instincts, determining tendencies, or any other word that represents that which we as individuals innately are, that which characterizes us as persons with individually preferred forms of life. . . . The living self consists

¹ J. E. W. Wallin, *Clinical and Abnormal Psychology*. Houghton Mifflin Company, 1927.

² L. L. Thurstone, *The Nature of Intelligence*, pp. xvi, 11 f. Harcourt, Brace and Company, 1924.

of impulses to action, and the conflicts of these impulses. The conscious self I have thought of as made of impulses that are for some reason arrested while partly formed, incomplete impulses that are in the process of becoming conduct. . . . Stated in a nutshell . . . psychology starts with the unrest of the inner self, and it completes its discovery in the contentment of the inner self.

Why do human beings behave as they do? How can we explain the behavior of the delinquent, the criminal, and the demented? Why does the individual make a particular choice when several alternatives are open? Why does the boy behave differently, in some respects, from the girl? How does the learner accomplish his tasks? What mechanisms are involved in the satisfaction of hunger or of intellectual interest? What are the springs of human conduct? These and other similar questions are concerned with the motivation of behavior. If parents and teachers fully understood how children behave and why they behave, they would know better what situations to set up in order to secure the desired behavior. They would understand better how to stimulate, inspire, and direct the learner in all his activities. In this chapter we shall consider some of the fundamental aspects of motivation.

"Motivation" is the term most frequently used to denote the springs of action, be they native or learned. It is a general term which denotes internal causes of behavior. Numerous terms used in this connection include the following: motive force, motive, urge, drive, incentive, want, need, craving, appetite, desire, wish, determining tendency, tendency to action, attitude, set, impulse, interest, aim, purpose, instinct, and prepotent response. These twenty-one synonyms have certain theoretical and terminological differences. A motive, according to Perrin,¹ "refers to an

¹ F. A. C. Perrin, "The Psychology of Human Motivation," *Psychological Review*, Vol. XXX (1923), pp. 176-177.

'inner' psychological process or function, a driving force to be found chiefly within the organism itself. And in the second place, the term suggests a plan, purpose, or ideal, with definite implication of an ideational element. This second conception, of course, includes the first, but even more than the first it belongs to human psychology."

Tolman¹ writes:

The appetite (or drive in the sense used here) is evoked directly by a specific type of inherent physiological disturbance. This disturbance, when active, drives the organism to 'seek' (more or less successfully) a given type of external end-object or situation (example — food, sex-object, rest-object). {The driving condition is initiated, internally, as the result of a metabolic rhythm. When this rhythm has reached the proper point in its cycle, the organism becomes restless and embarks upon exploratory movements until finally it comes by chance (or by direct intent) into the presence of an appropriate type of external end-object (or situation). It then releases a 'consummatory' response (innate or acquired), e.g., eating, sex-activity, muscular relaxation, etc. Such is the normal sequence. . . . The ultimate drive is for the removal of the driving physiological conditions (or the prevention of the physiological injury or interference). It is these physiological needs which, in the last analysis, are sought and avoided.

Woodworth expressed essentially the same point of view in his "Dynamic Psychology," which appeared in 1918. According to him, the drive (or motive) explains why the individual makes certain responses, and mechanisms explain how such activities or reactions are performed. Analogous to the drive is the gas or steam or electricity that operates a machine, while the gears, levers, etc. constitute the mechanisms. The nature of the machine may be said to determine the manner in which the motive force is applied.

¹ E. C. Tolman, "Nature of Fundamental Drives," *Journal of Abnormal and Social Psychology*, Vol. XX (1925), pp. 350 f.

Another point of interest is emphasized by Woodworth when he shows that one physiological mechanism, upon becoming partially excited, or in a state of tonus, becomes the drive for another. Tolman and Woodworth hold what is generally known as the "drive-mechanism" interpretation of motivation.

Collings and Wilson¹ define drive as "that inner urge or impelling force resulting from some internal or physiological condition of the child which causes it to respond along a definite line of behavior. It is that force which causes the child to 'face' the stimulus, so to speak, until the final goal is reached." Many attempts have been made to classify human motives, but they have not been successful for the reason that many of the motives apply to a group which are more or less similar rather than to single and distinct drives. Motives may be considered as being physiological and social. In all motives, however, there is a physiological factor; and in many of the motives the social factor operates. Another common classification follows:

1. Motives aroused primarily by organic conditions, needs, or cravings, such as hunger, sex, thirst, and sleep.
2. Instinctive and prepotent tendencies, such as self-assertion, fighting, and manipulation.
3. Emotions and feelings of satisfyingness and annoyance (closely related to 1 and 2).
4. Unconscious forces.
5. Habits, attitudes, ideals, interests, sentiments, purposes, and mind sets.

The hunger drive in a wild beast and savage is primarily physiological. With the civilized man, both the drive for food and the satisfying of the hunger are highly socialized. The sex drive is even more conditioned by society, so much so that frequently it is not consciously recognizable to

¹ Psychology for Teachers, p. 59.

the individual. The unhygienic effects of over-repression of fundamental physiological drives are well known.

Illustrations of social drives are abundant. A child usually does his best work when there are other pupils of similar attainments in the class. The learner responds to the presence of the other pupils and enters with satisfaction into competition or coöperation with them. Human coöperation and group solidarity are often heightened when danger threatens. Recognition of an individual by others of his group motivates him to put forth greater effort. In school the child likes to engage in activities that are success-bringing, not only because success is directly satisfying, but also because it brings recognition from teachers, parents, and fellow students.

THE NATURE OF DRIVE

Some significant studies have been made of the nature of drive. Kempf¹ explains motivation in terms of visceral tensions and endocrinal activities. The cerebrospinal nervous system executes behavior, that is, furnishes the basis for explaining how human beings behave, while the autonomic nervous division explains why they behave as they do. In other words, the autonomic system motivates. The drives are states of tension that require relief. While drive involves the whole organism, it concerns primarily the autonomic division, since both the smooth muscles and the endocrines, the chief mechanisms of tension and relief, are associated with autonomic segments. The craving for food is a visceral reaction, determined primarily by the tone of the muscles in the stomach walls. A change in the tonicity of the muscles may be induced by placing before the individual some ill-smelling food. Thus somatic stimuli,

¹ E. J. Kempf, *The Autonomic Functions and the Personality*, 1918.

involving the cerebrospinal system, frequently combine with the visceral stimuli in arousing or satisfying a craving.

According to this theory, when smooth muscles are in a state of normal tension, satisfaction results. Unpleasantness is associated with a spastic, tonic condition of smooth muscles. This latter condition initiates nerve impulses which are discharged into cerebrospinal nerves. The organism then acts to bring relief.

Another theory of importance is that of Herrick,¹ who assumes that dynamic behavior is partly owing to the reserve of vital energy in the body. The metabolic process normally involves a constant storing or accumulation of energy and the using of this energy according to needs. Stimulation of the body may result in a reaction that persists for a while, with the result that some adaptation is made to the situation. One reaction sets off another reaction, and the situation as it then exists sets off another, and so on until the reserves of energy are depleted and exhaustion results or until an adequate response is made.

Herrick believes that the brain is the seat of unusual reserves of vital energy. He writes:

In times of stress a man will outlast a horse, and an educated man may outwork an uncultured man of much more powerful physique because the cortical reserves are available to drive jaded muscles on to an intense effort long after fatigue has exhausted the normal capacities of the sub-cortical apparatus. A part of this superiority lies in the intelligent conservation of effort in the earlier stages of a long program of severe labor and other expressions of the reserves of associational patterns. . . . But a part of this superior efficiency results from direct activation by the cortex, which acts like a spur to an exhausted horse.

All activities are nerve-exhausting or energy-depleting. Those that are of an innate character are less depleting

¹ C. J. Herrick, *Brains of Rats and Men*, pp. 312 ff. University of Chicago Press.

than those which involve higher thought processes. No energy is released without cause.

Cannon¹ entertains the view that the emotions are the source of power and that they are drawn on every day in all cases which involve crises or excitement. The emotions involve activity of the autonomic segments, the endocrines and smooth muscles. Cannon's view is thus in partial agreement with that of Kempf.

Emotion is an emergency-serving function. In time of crisis or excitement, motor impulses from the cerebrospinal system involve the autonomic division, which in turn activates certain functions and inhibits others. This provision aids in enabling the organism to cope successfully with the situation. Processes like digestion and peristalsis are inhibited for the moment, while the heartbeat is accelerated, the inspiration is increased, the body temperature raised, the energy-giving compound in the brain is "mobilized," oxidation is speeded up, glycogen is released in the liver, and the adrenal and thyroid secretions are increased. These physiological changes increase the output of energy. The emotions are one of the great sources of energy.

The emotional urge may be a compensation for inferiorities or weaknesses of the organism.² Thus an organic weakness like a clubfoot may result in the possessor's turning his efforts to writing or painting with a determination to succeed.

A school failure in a foreign language may bring rebuke from parents, teachers, and classmates and thus stimulate the student to compensate for his weakness by turning his talents into engineering. Success in one subject may give him compensation for a deficiency in another subject. It is

¹ W. B. Cannon, *Bodily Changes in Pain, Hunger, Fear, and Rage*, pp. 216 ff. 1920.

² P. A. Witty and Lehman, "Drive: A Neglected Trait in the Study of the Gifted," *Psychological Review*, Vol. XXXIV (1927), pp. 364-376.

not always clear to the learner why he puts forth so much effort at tasks. He may or may not know that his drive involves mental compensation. Many cases show no evidence of compensation. Usually it is better for the learner to recognize his condition and make a wholesome adjustment.

Dewey stresses interest as the great motivating force. Experiments have provided evidence that interest is a powerful drive. Some writers believe that purpose, a mind-set-to-an-end, is perhaps more important in motivating pupils than all other motives combined. Some other authorities stress the potency of ideals both as drives and as controls.

Thorndike¹ accounts for drives in terms of physiological readiness of the situation-organism-response mechanisms involved. A drive involves connections and states of readiness. A situation sets off a series of reactions. These reactions are not made with equal facility. Some of the connections are ready to act at once; other connections are delayed in their responses. Hunger, thirst, fear, and love may increase the readiness of responding in an appropriate way, while other conditions delay or inhibit them, as a full stomach inhibits the tendency to eat. Thorndike expresses it as follows:

I believe that the original tendencies of man to be satisfied and to be annoyed — to welcome and reject — are described by these three laws of readiness and unreadiness: (1) that when a conduction unit is ready to conduct, conduction by it is satisfying, nothing being done to alter its action; (2) that for a conduction unit ready to conduct not to conduct is annoying, and provokes whatever responses nature provides in connection with that particular annoying lack; (3) that when a conduction unit unready for conduction is forced to conduct, conduction by it is annoying.

¹ Educational Psychology (Briefer Course), p. 55.

The explanations by Kempf, Herrick, Cannon, and Thorndike appear more inclusive than others; and of these explanations, Thorndike's seems the most serviceable to students of psychology and education.

Collings and Wilson¹ attribute the following characteristics to behavior with a drive: (1) it is spontaneous; (2) it is variable; (3) it is persistent; (4) it usually terminates as soon as the consummatory response has been effected; (5) it is unitary, it is the whole learner or personality that responds to the situation; (6) it is modifiable. It is this characteristic that provides the basis of all learning.

MOTIVATION IN SCHOOL

The teacher is concerned less with the nature of learning and more with the actual motivation of pupils in school. One reason why the problem of motivation is acute in school situations is the fact that teachers often attempt to teach subject matter which has little value to the individual, either as a child or as an adult. When students see some real and valuable reason for learning or activity, they usually enter upon the activity with zest. To plod through a subject merely for the sake of so doing appeals to few. Many activities are too difficult for the learner. Frequently the child is not properly introduced to the activity, or he is not allowed sufficient time to assimilate what he has learned. These, and other conditions that should never be, make it necessary for pupils to be stimulated in many ways. If ideal curricular materials, ideal teaching, and good health on the part of the learner could be secured, there would be little need of artificial incentives. The feeling of satisfaction that accompanies success and abiding interests would in themselves motivate the learner.

¹ In "Psychology for Teachers," pp. 78-82.

Thus activity leads to further activity. Since ideal conditions seldom obtain in the curriculum, the organization, the teaching method, or the physical condition of the learner, it is necessary to consider some of the ways of motivating behavior.

Sometimes motivation may be valuable; sometimes it works against the best interests of children. Who has not seen tired, ill, or nervous children overworked by a teacher bent on making a good showing for her room? Various methods of stimulating children may be recommended, but these should be used judiciously. One of the best ways to motivate pupils is to encourage them to keep graphic records of their progress from week to week or month to month. If cross-ruled paper is not provided by the school, pupils can prepare their own paper for graphing results. Obviously, only activities that can be measured readily can be recorded in this manner. The charting of standard test results for the different school subjects is often profitable.

The development of interest is the best of all incentives, since interest begets interest. Teachers often resort to artificial incentives that have little or no value educationally. The earmarks of a good incentive are as follows:

1. It should be a means to the desired end rather than the goal of activity. For example, an award of monetary value may stimulate the pupils to work for the prize in place of the benefits of learning.

2. It should make an almost universal appeal. If an incentive motivates only one or two members of a class, it fails in its purpose. Giving gold stars only to pupils who make A's is wrong in principle, since only very superior pupils will be interested. Giving gold stars to pupils who show improvement in their work, regardless of quality or quantity, would be much better.

3. Finally, the incentive should have permanent value. Incentives that motivate the learner only until the prize is won are not worthy of a place in the modern school. In this respect interest, which is really a motive, becomes the best of incentives.

Sometimes rivalry is stimulated for the purpose of motivating pupils. If the rivalry of the learner is with himself, — that is, if he attempts to improve his own previous record, — it is commendable. If two groups of approximate equivalence are pitted against one another, the results are often very satisfactory, providing the competition is properly directed. Having one child compete against another is bad mental hygiene and is unsound psychologically. There is no psychological reason why John should read as well as Frank, or why Mary should sing as beautifully as Florence. It is unreasonable to expect them to do so. They differ in their biological inheritance, in their physical and social environment, in their education and training, and in their physical condition. It is important only that the activities be educative and that the learner show progress commensurate with the conditions involved.

QUESTIONS

1. How may a knowledge of human physiology help us better to understand the problem of motivation?
2. What is motivation? a motive?
3. Distinguish between preparatory and consummatory responses.
4. How do physiological motives differ from social motives?
5. What are the chief classes of motives?
6. What is Kempf's explanation of motivation? How does it differ from the explanations of Herrick, Cannon, Witty and Lehman, and Thorndike? What are the advantages of each of the above explanations?

7. What are the characteristics of dynamic behavior?

8. What are some of the ways and means of motivating school children in the classroom?

REFERENCES

- COLLINGS, ELLSWORTH, and WILSON, MILBOURNE O. *Psychology for Teachers*. Charles Scribner's Sons, New York, 1930.
- GIFFORD, W. J., and SHORTS, CLYDE P. *Problems in Educational Psychology*, Part III. Doubleday, Doran & Company, Garden City, 1931.
- JORDAN, A. M. *Educational Psychology*, Chap. II. Henry Holt and Company, New York, 1928.
- SKINNER, C. E., GAST, I. M., and SKINNER, H. C. *Readings in Educational Psychology*, Chap. VII. D. Appleton and Company, New York, 1927.
- TROW, W. C. *Educational Psychology*, Chap. II. Houghton Mifflin Company, Boston, 1931.
- WHEELER, R. H., and PERKINS, F. T. *Principles of Mental Development*, Chap. XVI. Thomas Y. Crowell Company, New York, 1932.

CHAPTER VII

FEELINGS AND EMOTIONS

Feelings and emotions play important rôles in life. They give life its color and zest, and make happiness possible. They contribute to man's standards of value, his appreciations, interests, and enthusiasms. They furnish many of the dominant motives and drives. They are often saving forces in emergency situations. They may contribute to health and general well-being or may be a liability to both body and mind. They facilitate or inhibit learning in proportion to their strength and the satisfyingness and annoyance attending the activity. They make possible all kinds of congenial and enduring associations as well as wars of great cruelty. They serve as the genesis of, and basis for, a wide range of behavior, including our voluntary actions and decisions. All that makes life worth living may be attributed to feeling and emotion.

FEELING

Feeling is the mild composite of pleasantness and unpleasantness that accompanies every activity. Every sensation and idea response has its feeling aspect. Feelings are always personal and individual. They seem to pervade the entire body and appear to result from the action of the body as a whole.

Two theories of feeling are considered here. According to one view, feelings of pleasantness and unpleasantness are determined by the readiness of neurone patterns to func-

tion. When the neurones are in one state or condition, pleasantness or satisfyingness characterizes our behavior; and when the opposite, unpleasantness or annoyance results. Between the extremes of pleasantness and unpleasantness, we have all degrees of satisfyingness and annoyance.

A second theory regards feelings as "blends of organic sensations." Pleasantness and unpleasantness result from different organic reactions to stimuli. An emotion is simply the blend or complex of sensations induced by a series of stimuli and activity. Pleasantness and unpleasantness are merely blends or complexes of sensation-qualities. This theory, for which there is no experimental evidence, may be objected to on the ground that it assumes two mutually exclusive types of organic changes which go with the two feelings.

Simple feeling is an abstraction. Pure satisfyingness or annoyance are never experienced alone. What is experienced "is always an agreeable idea, a wish-to-be-forgotten memory, an annoying emotion, an agreeable perception, and the like." Feelings, involving blends of sensations and ideas, are what we really experience. When feelings involve more or less of a complex of organic sensations, that is, when a "conscious, stirred-up" condition of the body exists, we label the response as an emotion.

CLASSIFICATION OF FEELINGS AND EMOTIONS

Many attempts have been made to classify the feelings and emotions. Feelings are either pleasant or unpleasant. Feeling complexes have been classified as (1) sensory (those evoked in response to bodily functions, to instinct, or to mere sensations); and (2) intellectual and æsthetic (those that arise in response to meanings and intellectual insights). The latter class includes the intellectual, moral, æsthetic,

and religious feeling complexes; they are the result of education, training, and association with others.

Some psychologists recognize three general types of emotions. These function in connection with the activity of the different divisions of the autonomic system. The cranial and sacral divisions are antagonistic in functions to the sympathetic. The normal organic functions of the body are associated with the cranial and sacral divisions. These divisions are also involved in arousing the quiet and pleasant emotional states or comfortable state of well-being, and the mild emotions of joy, happiness, appreciation of art, music, literature, and satisfaction in one's companions. The sacral division is also concerned with the sex life and gives rise to what is called the sex emotion.

The three general types of emotions are the following:

1. The strong "emergency emotions" depend on the discharge of the sympathetic division of the autonomic system. Since the sympathetic division acts as a whole, these emotions must be organically much alike. They may, however, differ in degree from very slight to very great intensity. These include anger, fear, excitement, shock, uneasiness, nervousness, embarrassment, extreme pity, sympathy, elation, and enthusiasm.

2. The mild, joyful, pervasive emotions depend upon the activity of the sacral and cranial divisions of the autonomic nervous system. The sensations thus provided are usually mild and barely perceptible. Since they arise from normal, healthful bodily functions, they are not often thought of as emotions at all.

3. The sex emotions depend on certain activities of the sacral system. Presumably there are different types of sex sensation-complexes. Some of them vary in degree from slight to great intensity.

INSTINCT AND EMOTION

That emotion is closely related to reflex and instinctive modes of behavior is evident, since the responses that result from the stimuli are due to innate connections or conditions of the reaction systems. Emotional reactions occur as unlearned tendencies, and in this way they resemble instinct. There are certain differences, however, which are to be noted. Instinct applies primarily to acts which involve the voluntary, or striped, muscles and which are evoked directly by the central nervous system. Emotion refers primarily to the responses of the involuntary, or unstriped, muscles, which involve the nerves of the autonomic system. The emotion may be viewed as a preparatory reaction that puts the organism into a state of readiness for making a final reaction. Instinct is always directed to the end or consummatory reaction. The jump that follows the bright flash of action and crashing of thunder is a reflex act. The changes in circulation, respiration, peristalsis, and glandular secretions result in a complex mass of sensations and feelings. These constitute the emotion. In general, the emotion refers to the consciousness of the involuntary responses of the body to certain stimuli from the deep-lying organs. The stimuli cause a series of responses in the muscles and glands that are mainly under the control of the nervous system. The sensory ends in these receptors send back impulses to the brain. The complex response resulting from the total of stirred-up conditions is the emotion.

THE PRIMARY EMOTIONS

Watson cites three primary emotions that occur by virtue of the native constitution. These are *fear*, *rage*, and *love*.

✓ To these three Hollingworth would add *gloom*. Woodworth

lists as primary emotions anger, fear, lust, the comfortable state appropriate to digestion, grief, mirth or amusement, disgust, curiosity, the "tender emotion" (felt most often in the mother toward her baby), and thinks it probable that we have a few others. In contrast with the primary emotions, we have other emotions that are derived from the primary and that depend for their nature upon individual experience.

PHYSIOLOGY OF EMOTION

Emotions involve a more intense mental and bodily state than feelings. Unlike the latter, emotions are definitely related complexes of organic or visceral sensations. Emotion is considered by many as the consciousness resulting when certain stimuli arouse deep-seated muscular or glandular responses. According to the James-Lange theory, emotion is the awareness of sensations from the bodily organs occasioned by some stimulus. To be more specific, the theory is that "the bodily changes follow directly the perception of the exciting fact, and our awareness of the same changes as they occur, is the emotion."¹

Herrick² regards emotion as "a product of visceral action, involuntary muscles, glandular secretion, and especially the activity of ductless glands, all interwoven with sympathetic nerves through which the brain bridles and guides the course of events. The visceral activities and the conscious experience of emotion are cross-connected both ways. Visceral action may call forth emotion, and emotion may change the visceral processes profoundly. This is a circular reaction; each component may reinforce the other, on and on in a cumulative way."

For Herrick, the physical structures of emotion involve

¹ James, *Psychology* (Briefer Course), p. 375. 1892.

² C. J. Herrick, *The Thinking Machine*, pp. 211-212. 1929.

"the involuntary visceral apparatus, the nervous and muscular apparatus of expression, and the central control works of the brain."¹ It is the thalamus of the brain that serves as the center "for the coördination of emotional reactions all over the body, and here are the organs whose activities give us our awareness that an emotional reaction is going on and our satisfaction or dissatisfaction about it."² It is the cortex, however, that is responsible for the direction and control of the emotions. Cannon and Crile are likewise in essential agreement that the visceral processes play an important rôle in emotion. Both are of the opinion that emotion is an emergency-saving mechanism, useful to the individual and the race alike.

Expressions of emotions can be observed every day. They give to emotions their vividness and life. In anger the fists are clenched, the teeth are set, the posture is rigid; in fear the muscles collapse, the joints tremble, and the mechanism for flight is activated. The emotions stimulate the muscles which would be used if the appropriate physical actions were carried out. If the activities are executed, the glycogen and the activating secretions from the thyroid glands, the adrenals, and the pituitary body are consumed.

Experiments have been made which show the following physiological changes in animals having strong emotions: (1) A mobilization of the energy-giving compound in the brain cells; (2) an increased output of adrenin, of thyroid secretion, of glycogen, and an increase of the power of oxidation in the muscles; (3) accelerated circulation and respiration with increased body temperature; (4) altered metabolism. All these changes are adaptations which have for their end the increase of efficiency of the body. Coördinate with these changes we find an inhibition of the func-

¹ Ibid. pp. 213-214.

² Ibid. p. 202.

tions of organs and tissues which consume energy but which do not contribute to motor efficiency. Strong emotions, such as anger, grief, and fear, inhibit the appetite and the processes involved in digestion and excretion. X-ray studies of cats while digesting food both before and after being excited by a strange dog show conclusively that the processes of digestion and peristalsis are inhibited. In fear the mouth becomes dry, and the gastric and pancreatic secretions, as well as the peristaltic movements of the whole alimentary canal, are inhibited. These changes prepare the animal for action by withdrawing the blood from the abdomen for use in the muscles and organs directly involved in action.

Two of the ductless glands, the adrenal and the thyroid, are undoubtedly active in emotion and useful in bodily economy. During fear and excitement the adrenal glands produce a substance that is taken up by the blood. This substance affects quickly various bodily processes. It provides the best sort of food for the tissues by releasing glycogen which is stored in the liver. It increases the heart rate and contraction of the blood vessels, and this condition causes the blood to rush the supply of assimilable food to the tissues. It also causes the blood to coagulate more quickly if it is exposed to the air. Lastly, it produces temporarily a constriction of the small blood vessels. This increases the blood pressure, which in turn facilitates the washing away of fatigue products from the muscles so as to diminish the effects from fatigue. The increased coagulation and constriction of the blood vessels diminish the loss of blood in case of wounds as a result of fighting, which often follows emotion in animals.

The thyroid glands are intimately related to nervous and mental action. There is clinical evidence that a relationship exists between secretions of the thyroid glands and

the presence of emotions. Increased secretion of the thyroid is paralleled by increased susceptibility to emotion. Also, protracted emotion results in an increase in thyroid activity and an increased susceptibility to emotion. In pathological conditions we have a vicious circle: The increased activity of the thyroid glands, produced directly or indirectly, increases emotion or irritability, which in turn results in an increased amount of thyroid activity.

While thyroid secretions are slow in producing behavior effects, such changes, when induced, may persist for several days.

MOODS, TEMPERAMENTS, AND SENTIMENT

"Emotion" is a term used to denote an experience that can be marked off fairly well. A mood is a persistent emotional tendency. One may be despondent for a considerable period of time and as a consequence of this be more disposed or susceptible to emotion closely related to this mood.

The term "temperament" applies to still more enduring mental states. It refers to the predominating mood of a lifetime. The historical and classic division of temperaments into sanguine, melancholic, choleric, and phlegmatic has little basis in fact; but, while no sharp cleavages exist between one temperament and another and while every individual is a composite of all four, the classification is useful in characterizing certain differences that are known to exist in some amount. The choleric type is easily provoked and characterized by intensity of feeling, while the sanguine, although easily provoked, is relatively feeble in emotional reaction. The melancholic type is slow in response but characterized by intense sadness or gloominess when once evoked. Phlegmatic types are slow to act and disinterested or cold to ordinary situations in life.

Many psychologists are inclined to the view that traits

of character are distributed approximately according to the theoretical probability curve. If we consider such a trait as cheerfulness, the majority of people are cheerful; a smaller number are very happy; and a like number are very sad. Not infrequently we find individuals manifesting pronounced emotions when no objective stimulus appears to be present to the senses. Such a condition appears only in the insane or in persons who are temporarily affected by some drug, narcotic, toxin, or pathological condition.

A sentiment is a relatively permanent disposition or attitude organized about the various objects, judgments, or imaginations that excite it. Love of home and country and respect for one's flag or *alma mater* are examples of sentiment.

The following forms of sentiment have been recognized: intellectual, moral, social, religious, and æsthetic. While they are called forth by different kinds of situations, it is probable that sentiments do not differ radically in essentials from group to group.

GENERAL EMOTIONALITY

The term "general emotionality" is used to denote the condition of individuals who are usually susceptible to all sorts of emotions. Normal individuals range in general emotionality from the stolid, calm, or lethargic persons on the one hand to the hypersensitive, highly emotional, and excitable on the other. These characteristics are but extremes of a group of tendencies possessed by all people. Extreme conditions in either direction border upon the abnormal.

In general, extreme emotional sensitivity is accompanied by emotional instability and excess. It is probable that such a condition is owing to hypersensitivity of the auto-

nomie nervous system. Individuals who are constitutionally predisposed to emotional excesses or who are totally lacking in emotional responses are psychoneurotic.

MODIFICATION OF EMOTIONS

Like all other tendencies having a "native" core, primary emotions may be modified by (1) substituting a socially acceptable reaction for a primitive reaction; (2) adding to the stimulus so that the original emotion will not be elicited; and (3) combining or blending one emotion with another. Among the many emotional blends, the following are easily recognized: reverence, gratitude, sympathy, remorse, disappointment, and pity.

THREE STRONG EMOTIONS

1. *Fear*. Fear influences every organ and tissue in the body. Each organ or tissue is stimulated or inhibited according to its use or hindrance in securing an adequate biological adjustment. By the concentration of all forces on the neuromuscular mechanism, greater power is developed. Under the drive of fear one is often able to perform almost superhuman feats. The use of all the forces involved during an emergency may leave the individual in an exhausted state after the experience of fear.

There are three important ways of dealing with fear when it makes its appearance. The example of parent and teacher is effective in inhibiting tendencies toward fear in children; efficient fire drill and a calm voice of command may prevent a panic. The fear responses can be lessened by associating some original satisfier with the stimulus that arouses fear. Appeal to the child's knowledge and reason may also be used to prevent a situation from evoking fear. The value of this method depends upon the age, experience, and mentality

of the individual. Fear has its place in the order of things. In a modified form it is necessary for the maintenance of society. As civilization advances there is a diminished demand for the use of fear as a controlling factor.

2. *Hate*. Hate in its cruder forms is a characteristic of the savage mind. It arises when there is a blocking of an emotion or a desire. Hate is a destructive emotion, and those who seek to rule by it must ultimately fail. It has no place in modern society. How can the individual who hates somebody or something be restrained or reconditioned? We turn to William James for the answer. James says:

Love your enemies, your positive and active enemies. Either this is a mere Oriental hyperbole, a bit of verbal extravagance meaning only that we should, insofar as we can, abate our animosities, or else it is sincere and literal. Outside of certain cases of intimate individual relations, it seldom has been taken literally. Yet it makes one ask the question, Can there be in general a level of emotion so unifying, so obliterative of differences between man and man, that even enmity may come to be an irrelevant circumstance and fail to inhibit the friendlier interests aroused? If positive well-wishing could attain so supreme a degree of excitement, those who were swayed by it might well seem superhuman beings. Their lives would be morally discrete from the lives of other men, and there is no saying . . . what the effects might be. They might conceivably transform the world.¹

3. *Anger*. Anger may be controlled by directing attention to the emotion itself, by counting ten before saying the cutting word or striking the blow, or by working off the energy in some violent exercise. The observation of others who are angry may check one's own anger; a reflective attitude, or even a feeling of amusement, may follow. "A soft

¹ William James, *Varieties of Religious Experience*, p. 23. Courtesy of Longmans, Green & Co.

answer turneth away wrath" is a proverb psychologically sound in situations where anger and hate are to be found.

The individual gains control of his emotions, thoughts, and actions through education. Society controls them in the individual and the group through such agencies as customs and traditions, personal beliefs, law, government, education, art, and public opinion.

TRAINING IN ÆSTHETIC PLEASURE

Every normal child can develop some measure of appreciation for art, music, literature, and nature. Children from early infancy should have experiences in each of these fields for the sake of the sheer enjoyment. Too often appreciations are nipped in the bud by having the children attempt to dissect or analyze selections of literature and music before they are able to do so with interest.

In order to secure the appreciation of a selection of literature, a work of art, or a piece of music, the teacher must (1) provide the proper experiences which will make possible the pupil's appreciation of the purpose of the artist or musician or author; (2) provide for the understanding of the thought or content of the selection; (3) study with the pupil the medium of expression, the form in which the selection has been put, and its adequacy to the content; (4) call for definite responses to the selection with a view to developing sound standards of value which are the pupil's own.

In the same way each emotion is subject to control and modification. Desirable emotions can be developed into useful habits, attitudes, and ideals; undesirable emotions may be inhibited through lack of exercise. Thus the formation of desirable emotional patterns may be acquired by any normal individual. The trend in education is toward

the intellectual rather than the emotional development of children. This may be owing to the absence of knowledge and skill in the latter field. It is vastly more important to teach the child to control and direct his emotions than it is to have him solve correctly the problems involving square root. The meaning and value of life center in proper emotional responses.

EDUCATION OF THE EMOTIONS

Although inherently instinctive in character, emotions are subject to control within limits. As a rule, they are not to be repressed; the mental hygienists recommend that there be intelligent control of the emotions. This must not be interpreted to mean the abolition of all discipline and complete freedom to all kinds of emotional outbursts. It means reasonable freedom for expression under wise guidance that is neither vacillating nor inconsistent. Society demands that certain tendencies be checked. Psychiatrists, however, sense the dangers involved in too much thwarting of emotional tendencies. The desired results can be realized by avoiding all unnecessary conflicts that annoy the child. "Dont's" give way to "Do's." The child's antisocial tendencies are thus gradually modified into those which meet the approval of society.

By using the same methods that have been discussed in connection with instinct, desirable changes in emotional behavior may be secured. It is very important that emotions find expression in worthy thoughts and deeds.

Every time a resolve or a fine glow of feeling evaporates without bearing practical fruit is worse than a chance lost; it works so as positively to hinder future resolutions and emotions from taking the normal path of discharge. There is no more contemptible type of human character than that of the nerveless

sentimentalist and dreamer, who spends his life in a weltering sea of sensibility and emotion, but who never does a manly concrete deed. . . . The habit of excessive novel-reading and theatre-going will produce true monsters in this line. The weeping of a Russian lady over the fictitious personages in the play, while her coachman is freezing to death on his seat outside, is the sort of thing that everywhere happens on a less glaring scale. Even the habit of excessive indulgence in music, for those who are neither performers themselves nor musically gifted enough to take it in a purely intellectual way, has probably a relaxing effect upon the character. One becomes filled with emotions which habitually pass without prompting to any deed, and so the inertly sentimental condition is kept up. The remedy would be never to suffer one's self to have an emotion at a concert, without expressing it afterward in some active way. Let the expression be the least thing in the world — speaking genially to one's aunt, or giving up one's seat in a horse-car, if nothing more heroic offers — but let it not fail to take place.¹

Children and youth who are especially susceptible to repression should be given special and individual treatment. Every attempt should be made to keep their emotional life on an even tenor. Causes for violent outbursts of temper are to be avoided. The child needs great freedom to make choices that are consistent with a reasonable standard of discipline. The training for self-control should be carried on so far as possible in coöperation with the parents. Tact must often be resorted to in getting their coöperation. Not infrequently the child is a mirror of the parent. The child is often unstable emotionally either because of inherited tendencies or as the result of association with emotional parents. In guidance great care is required lest the parent be alienated and the work of helping the child be made difficult. The child must control his emotions in his rela-

¹ William James, *Principles of Psychology*, Vol. I, pp. 125-126. Courtesy of Henry Holt and Company.

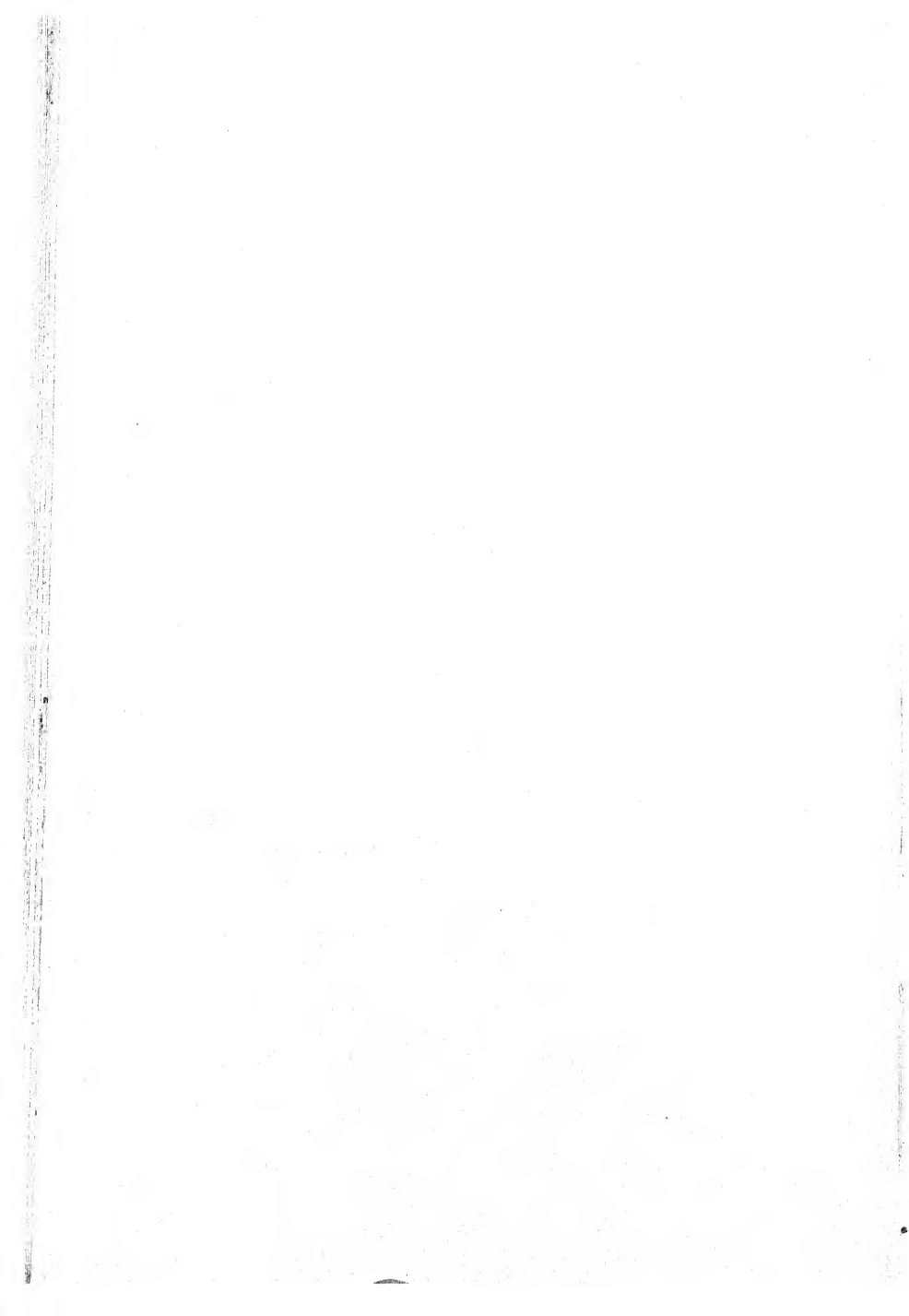
tion to others. He may learn to control his emotions when he finds out that nothing is gained and much is lost by giving vent to his feelings. Habits must be formed that are consistent with good behavior and mental health. Appeals to effort may be made through the use of penalties and rewards, or approvals and disapprovals. Situations involving group rivalry and social approval are often effective. Positive methods are better than negative ones. It is better to stimulate good tendencies than to repress undesirable ones. Vituperation, sarcasm, and irony are not to be recommended. The learner must not be humiliated or made more sensitive.

QUESTIONS

1. Distinguish between feeling and emotion as the terms are used by psychologists.
2. Of what value are emotions in the life of the individual?
3. What are the general types of emotions recognized in this chapter? To what extent are these emotions functions of the autonomic nervous system?
4. What is a primary emotion? How many are recognized by Watson? by Hollingworth?
5. Discuss the physiology of emotion from Herrick's point of view.
6. What is a sentiment? a mood? How are sentiments formed?
7. How may emotions be modified? Just what is included in the education of the emotions?
8. To what extent, if at all, do personality maladjustments and school discipline involve emotional disturbances?
9. How should pupils be directed in their learning so that they will appreciate good literature and art?
10. How may phobias and states of anxiety developed by school children be eliminated?

REFERENCES

- BAGBY, E. *The Psychology of Personality*. Henry Holt and Company, New York, 1928.
- CANNON, W. B. *Bodily Changes in Pain, Hunger, Fear and Rage*. D. Appleton and Company, New York, 1914.
- NOYES, A. P. *A Textbook of Psychiatry*. The Macmillan Company, New York, 1927.
- RAGSDALE, CLARENCE E. *Modern Psychologies and Education*. The Macmillan Company, New York, 1932.
- REYMERT, M. L. *Feelings and Emotions*. Clark University Press, Worcester, 1928.
- SHAND, A. F. *The Foundations of Character*. Macmillan & Company, London, 1920.
- SKINNER, C. E., GAST, I. M., and SKINNER, H. C. *Readings in Educational Psychology*, Chap. VIII. D. Appleton and Company, New York, 1926.
- TROW, W. C. *Educational Psychology*, Chap. III. Houghton Mifflin Company, Boston, 1931.
- WHEELER, R. H., and PERKINS, F. T. *Principles of Mental Development*, Chap. XI. Thomas Y. Crowell Company, New York, 1932.
- WOODWORTH, R. S. *Psychology (Revised Edition)*, Chap. VII. Henry Holt and Company, New York, 1929.



PART TWO · *Learning and Adjustment*

CHAPTER VIII

THE LEARNING PROCESS

In the preceding pages much has been said about the physiological nature of man — his biological inheritance and original nature. We have been told that the learner must be an individual with a nervous system capable of being stimulated by, and of responding to, a stimulus. In order that this may take place it is necessary that the individual have receiving organs, a connecting system, and a reacting mechanism. Whenever this nervous system functions, it changes; and these changes are essential to learning. From a physiological point of view, these changes are modifications of the nervous system. They occur through the process of natural development and through formal or informal instruction. This means that some of these modifications take place before birth and make possible our systems of reflexes and unlearned reactions; others result from stimulation of the sensory end organs and produce a reaction which in turn results in the arrangement of the elements of the neurones making up the nerve tissue. All learning results from some change in the nervous system.

Learning is ordinarily thought of as the setting up of new associations or connections. These associations form what are known as connections between responses and stimuli. These associations are involved in the formation of every habit and in every process of ideation.

The unlearned reactions, such as the eye-wink or pupillary reflex, are usually called reflexes and may remain through life with but little change, but most of the learned reactions are changed as new experiences are acquired. All learning above the lower reflex level involves both the formation and the reorganization of associations. Life consists of experiences, large or small, desirable or undesirable, and the individual's present body of effective learning is what is left of the sum total of his experiences after reorganization has taken place.

It has been established that all simple or complex learning, whether it be by man or by the lower animals, is of the same nature. The fundamental conditions remain the same. In the lower animals there is the same permanency and stability of reactions as in the lower reactions in man. In the higher animals and man complex learning takes place because of the possibility of forming neural patterns or associations. The associations or connections are either between the parts of simultaneous experience or between one experience and another which immediately follows it. Sometimes where there is no immediate relationship a connection may be formed because of the nature of the two experiences.

Throughout life we are forming neural patterns, and this makes our learning possible. All learning requires a stimulus or situation which arouses neural activity, and learning takes place when this activity facilitates a response or action. Learning takes place between the point of stimulation and the response. The reaction made after the stimulus has produced action is the only indication we have that learning has taken place. The pupil who sees a column of figures to add, proceeds to a definite response and then to the action of writing or giving the answer. Action is essential to learning. It is also the evidence of learning.

Learning consists of the formation of connections between situations and responses. Man has within his nervous system countless possibilities for the formation of connections. The teacher's chief business is to provide the proper and adequate stimulus and to guide the process of connection-forming so that desirable responses will be made.

Learning is a relatively positive process, never a passive one. It requires definite and determined action.

We come into life with definite neural patterns capable of sustaining life for a short time. Upon these patterns we build others. The inherited patterns are simple, while acquired ones, apart from the simplest habits, are complex. Without the neural structure no learning takes place in man. We do not acquire our nervous system; we organize its elements into working patterns. We use these patterns in acquiring experiences.

TYPES OF LEARNING

Trial and error. An important stage in all learning is the possession of a motive. The tendency of every organism is to retain its present condition of harmonious adaptation. While this condition exists, there can be no change. When a factor which is evidently unpleasant is introduced into the environment, the organism attempts to resist the intrusion and maintain its *status quo*. This may be done through the concentration of all inner resources. If the disturbing element cannot thus be overcome, then some form of adaptation must be made. This may involve an avoidance reaction, if possible, or eventually a reorganization of the organism to fit the new environment. The motive persists throughout until a successful conclusion is reached.

The procedure also involves the establishing of associations between the new stimulus and its response and an

active process in which many responses may be made and discarded as unsatisfactory before an adequate adaptation is made.

If repeated experiments with the same organism under the same conditions show no tendency to profit by previous experiences so that erroneous responses are gradually eliminated, the organism is recognized as merely adapting itself but not learning.

Jennings¹ cites the behavior of the infusorian *Stentor* when an irritating substance was placed in the water around it. The first reaction of the animal was a bending to one side as though to avoid the annoyance. This reaction was repeated several times without success. Then followed a reversed waving of cilia about the orifice in an effort to keep the source of irritation away. Not succeeding in this, the creature withdrew into its tube. It repeated this movement several times, then loosened itself from its foothold and moved to another location which was free from the annoyance. The creature had not only adapted itself but had learned from experience. Unsuccessful reactions had been eliminated. The animal had learned.

Although the learning processes of the higher animals and man are much more complex than the example given, they follow the same general type and the same principles. The simple stimuli become complicated and are called situations. Associations are far more varied and numerous, and reactions become more highly diversified with glandular, cortical, and muscular responses which lie outside the possibilities of the simpler organisms. To summarize; in every learning process are found the following basic characteristics:

1. Capacity for modifiability of neural connections.
2. A motive or incentive, whether recognized or not,

¹ H. S. Jennings, *Behavior of Lower Organisms*, pp. 174-175.

found in the tendency to avoid annoying conditions or to seek satisfying conditions.

3. A number of trials, at least one of which is successful in achieving the satisfying end.

4. The gradual elimination of unsuccessful reactions.

5. The selection and use of those reactions which by trial are found satisfactory.

6. Retention in neural patterns of the associations leading to the successful reaction, so that future conduct in the same circumstances is habituated.

We often hear of the "trial-and-error" type of learning. It would be more appropriate to use the expression "trial-and-error process" as a term descriptive of a certain stage of all learning. In some cases the emphasis on the trial-and-error process is more marked and more persistent than in others, individuals differing greatly in their dependence on it. In many tasks of learning the trial-and-error is not at all evident to the observer. The learner may substitute mental or imaginal reactions for motor responses. The trials are made and success or error is revealed in imagination before any actual motor adjustment is made. Operating without a deliberate plan is known as "blind trial and error." Most of the learning reactions of animals are of this type. It is impossible to state with any assurance how much of the learning of the higher animals is of the mental, or insight, type, but it is certain that deliberation is not a strong characteristic of even the higher primates.

The maze is commonly used in learning experiments and is adaptable to both animals and man. A hungry rat is placed in the starting box with food at the exit of the labyrinth. The rat is released and starts out in quest of the food. On the first attempt it makes numerous errors by going into blind alleys before it finds its way through the maze to the food. On succeeding attempts the useless

movements are eliminated, and the time is gradually decreased. Where wrong choices are accompanied by electric shocks or by other painful experiences, the right pathway is determined more readily. Throughout the experiment the rat is very active. Guides to successful responses appear to come chiefly from the olfactory and muscular senses.

When a human being is put into the same kind of maze, his first attempt to find the exit does not differ widely from that of the rat. Errors of the same kind are made. In this case the learner gives evidence of a different method of attack. He hesitates, observes the direction, form, and slight cues connected with the wrong and right paths, compares the results of these observations, makes a mental note of his findings, with their bearing upon success or failure, and deliberately attempts to remember them for future guidance. On successive attempts, the learner projects his imagination along the pathways before actually trying them and thinks out the best plan. At every instant he is active and is making use of trial-and-error methods, though not of the blind type.

Trial-and-error procedure is used likewise in other types of learning, such as those placing the emphasis on memorizing and on reasoning. When a poem is to be memorized, the learner, in his first attempt to fix the passage in mind, will hit upon certain associations which will later be discarded as more appropriate and effective ones are discovered. He will also make attempts to repeat the passage, or parts of it, from time to time. In case of failure he will note the part giving difficulty and will concentrate more definitely on that.

Pure trial-and-error or trial-and-success learning is probably present only in the early years of child life. Insight develops early from experience. The recall of a past experience with its attending comfort or discomfort will elimi-

nate all or part of the trial-and-error procedure. If there has been an error in his learning, it may affect his future actions and use of insight. The steps in learning involve insight. When rationalizations are to be wrong they may result in a new trial-and-error attempt.

Learning by observation and insight. In order that we may learn, we must do. There is no learning without action. The action may be of the hit-or-miss type and lead to no marked result. It may be a matter of controlled trial-and-error type, which may result in desirable action. Both these types are wasteful and expensive but essential to future growth. Most, if not all, of scientific research is a matter of trial-and-error activity. This type of learning is modified by careful observation and insight. Observation is a form of activity, and insight, that is, intelligent understanding, is necessary for proper interpretation. The insight or interpretation may give us meaning as well as relationship, both of which are valuable in the acquisition of knowledge and skill.

In the perfection of motor performances — such as the acquisition of skills — insight into the causes, results, and relationship is essential. Observation, especially directed observation, decreases the effort and time in gaining mastery and power. The adult's superiority over the child in the ability to solve problems is caused largely by greater powers of observation and insight into relationships.

While the young child uses haphazard movements at first, he soon learns to observe and then tries again; here trial and error both precedes and follows observation. With more experience, insight is gained, and further observations are made. This is followed by understanding. Understanding is an effective aid in the acquisition of knowledges, habits, and skills.

Blind trial and error is nonproductive; but trial and

error accompanying and following observation is effective. This is made more valuable when insight or understanding is present. Much of the learning by imitation is merely learning by observation followed by trial and error. Insight in learning removes accidental factors in learning. The ability to observe, then try, and then understand is evidence of a productive mentality.

LEARNING AND CONNECTION-FORMING

Learning is a complex process. It begins with sensory end organs and a nervous system plastic enough to be modified by experiences. In the physiological equipment the first essential to learning is a set of end organs capable of receiving stimuli and starting a sensory impulse over the sensory nerves.

One theory of the physiological basis of education is the modifiability of the synapse between neurones. The theory of synaptic resistance assumes that nerve impulses encounter resistance at the point of contact between two or more neurones. The more often the "path" is used, the weaker becomes the resistance. The resistance at the synapse determines the course of the impulse. Each sensory path makes connections with several motor and associating paths, and any impulse will take the course that offers the least resistance. The ease with which the synapses may be crossed determines the "path," and this in turn is determined first by inheritance and second by use. In the latter case, the course of an impulse through the brain is largely controlled by the synapses, whose degrees of resistance depend upon the frequency and satisfyingness with which they have been used. Use weakens the synaptic resistance and thus strengthens the bond, or connection, between the situation and the response.

Experiments indicate that many parts of the brain function at the same time. These parts may be widely separated; hence it is correct to say that the brain functions as a whole, not part by part. While motor and sensory areas can be marked off with some precision, there is no evidence of definite brain localization for percepts, images, memories, ideas, emotions, and other complex processes. There is still less possibility of precise localization of such complex traits as teaching ability, musical aptitude, mathematical ability, and the like. Mental qualities like cheerfulness, honesty, sincerity, loyalty, trustworthiness, industriousness, and courage have no focalized localization. Many parts of the brain are engaged in the most simple reactions. The entire nervous system seems to be involved in all mental functions. The explanation of learning as the formation of neural connections helps us to understand what learning may be conceived to be from the point of view of physiology.

From the physiological point of view, learning involves the use of sensory end organs, sensory nerves, the associative or connecting nerves, and motor nerves. All of these are essential to stimulus-response, or situation-response, bond or connection. They constitute the neural circuit. The neural circuit is essential to the formation of neural patterns. Mental life is a function of the nervous system. Healthy mental life depends upon the formation of desirable neural connections and patterns. The nervous system must be an integrated mechanism so that mental life will be coördinated and integrated.

The human nervous system is very complex. There is a well-formed "path" along a sensory nerve from each of the end organs to the cortex of the brain. When the sensory impulse reaches the cortex, it is transmitted over connecting or associative nerves to the motor nerves, which carry the impulse to the muscles or glands. An impulse once

started over the sensory nerve must find a way out. If it does not reach the terminal effector, it must have drained into some other neural pathway of discharge. It is the innumerable possibilities for connections and drainage that make possible the great complexity of the connection-forming system. By means of this complex connecting system and the conductivity of the neurones, it is possible to stimulate one sensory area and then another until a large area of the cortical region is made active in the solution of some particular problem.

The stimulation of a sense organ does not in itself produce a sensation. Sensations also involve cortical activity. Perception, the interpretation of sensation blends, involves not only the activity of neurone-circuits but also the re- arousal of previously formed connections or patterns. Imagining, remembering, reasoning, and acting likewise involve previously formed patterns or modifications of neural organization. Each and every reaction becomes a part of the total situation that influences each subsequent learning. In brief, how the individual behaves at any given moment is a product of his heredity, environment, and previous learning.

HABIT FORMATION

The human nervous system is exceedingly plastic and susceptible to impressions. Because of this tendency to adaptation, it is possible to condition responses to the individual needs. Plasticity—impressionability, modifiability—and retentiveness are essential to the formation of neurone patterns.

The innumerable neurones of the nervous system make reflex arcs possible. Changes in these arcs will necessarily change the composition of the sensory and motor impulses. When these changes take place because of exercise and

satisfaction, there comes into existence a new neural pattern, or motor pathway of discharge.

The conditioned reflex is a highly special and unique type of learning that seldom takes place in real life situations. The laws and conditions of ordinary learning apparently do not apply in this type of learning.

Habit is the relatively fixed way or combination of ways of reacting to situations. Habit formation is learning to perceive, to imagine, to remember, to feel, to think, to act, or to tend to act in the same way that one has done in the past. It involves relationships which make for mental economy. Each time a reaction takes place it is accomplished with decreased mental energy. The connection between the stimulus and the response is more direct and is made in a shorter period of time. The inhibitions and difficulties which originally interfered are gradually removed, and many of the intermediate responses, if not all, are eliminated. When a young child is learning to write, he first grasps the pencil tightly, presses the point hard on the surface of the paper, and makes many unnecessary movements and tensions of the muscles of the arm, face, and legs. As he practices again and again, these superfluous reactions are gradually eliminated and the pencil is handled lightly and easily.

Habit is very significant in animal life. It is fundamental to human learning. Education consists largely in the formation of habits. Some of these are comparatively simple; others are very complex. The manner of walking, peculiarities of speech, facial expressions, social conduct, and method of logical thought are complex forms of habit.

Progress would be impossible without habit, for all that one does is dependent upon what he has already done. If there were no provision for short-circuiting the processes; if one were forced to keep his attention on the almost in-

finite details which make up the complex behavior series, the mind could not be free to engage in the reorganization of past experiences in new combinations. The artist is able to paint his great masterpieces only when he gives little or no attention to such mechanical details as the holding of the brush, the execution of the stroke, or the fundamentals of composition and color-mixing.

THE PHYSICAL BASIS OF HABITS

Many acts are the results of an inherited form of nervous organization. These nerve patterns are not acquired by the individual but are a part of his native equipment. They enable him to perform many acts as well as to receive innumerable sensations. Instinctive acts do not result from intelligence but depend upon external stimulation and inherited organization. Certain habits are closely associated with instincts, such as our attitude toward animals or toward particular forms of danger. Such habits are easily shaped. Very often particular reactions may be a matter of chance. The human being begins life with many reflexes, some of which may be reorganized into habit-patterns.

Habits may become as fixed as instincts, but they grow out of individual experience. It is a well-known fact that as we grow older many of our native reactions are supplemented by habits. In the fixing of new patterns much depends on reactions already established. Not only are instinctive tendencies the basis on which such reactions are built, but they probably provide, in complex combination, the actual responses that become habitual. The neural organization in habit formation does not differ greatly from that for instinctive tendencies. It usually involves new associative centers in the cortex which are not essential to the operation of native reactions.

If it were not for the excitability and conductivity of nerve substance, it would be impossible to form habits. There would be no connection between the end organ sensitive to the stimulus and the central nervous system, and without this connection there would be no impression. It is only through exercise of the basic reflexes that the acquisition of habits is possible. The physical unit of the nervous system which makes habit possible is the neurone together with its synaptic connections. These connections are altered by the nerve impulse; and when once altered, the modification tends to remain more or less permanently. Whether this occurs as a result of polarization of molecules or of the lessening of resistance in the synapse is not known. No auditory stimulus simply goes in one ear and out the other. When it is transmitted into nerve impulses it leaves some "trace."

The law of indestructibility of energy provokes the question, Is the effect of a nerve impulse ever lost? The answer to this question is of prime importance to educators. Specific feats of memory, such as the occurrence of a clear image of an experience which one has not recalled for many years, give evidence that the change effected is stored in the nervous system and requires only a stimulus to release it. It may be possible for the effect of a nerve impulse to be entirely wiped out or for the experiences to be forgotten with no possibility of recall. It is evident that a habit may become less definite, less clear-cut, or less exact with time; but whether this is because the neural traces are ironed out or merely because of the conflict of associations and inhibiting effect of other habits is not at all certain.

The fact that neurones can be modified explains why repetition makes it increasingly easy for nerve impulses to pass over the same neural tracts. In considering a habit, the complete reflex arc involved in each simple process

must be taken into account. A break in the arc at any point prevents the condition of response which is requisite to habit formation. It is only when a certain movement is made in response to a stimulus, or is tending to be made, that a habit is being formed which involves this particular reaction.

The procedures involved in habit formation are differentiated from those which are native in that the latter are unlearned. The neural structure of the two is similar in principle, but habit formation involves new associative patterns in the cortex. As a rule, instincts are less complex in organization, though there are habits which compare very closely with them in simplicity. The ease with which habits are formed depends upon the sensitivity and modifiability of the neurones. If it were not for these factors, it would be impossible to increase skill and efficiency in motor or mental performance. The way we think is just as much a matter of habit as the way we act.

The process by which short-circuiting in habit formation takes place is not fully known. The following simple case may serve to make this process more concrete. The child sees a cat. As a natural reaction, possibly accentuated by past experiences, he reaches for the cat; he feels its soft fur and, following his custom, he strokes the cat's fur backwards; but the cat's action is different from that of any other cat he has known. It scratches him severely. In response to the sudden attack, he jumps back and cries because of the pain. His pattern of reaction is now changed. In the future, whenever the child sees a cat, the reaching and stroking reactions are inhibited. He jumps back, or cries, or does both. He has begun to acquire a new habit which may never be entirely eliminated. He is being reconditioned.

THE PROCESS OF CONDITIONING AND THE
BUILDING OF HABITS

Habits can be built only when there are one or more reactions. These reactions need not give any external evidence of their existence, for there is always some reaction taking place in the neurones of the nervous system. When a habit is being formed, neural arcs are used. The more times an impulse passes over a neural arc, the less the resistance to it. This is known in psychology as the principle of use, or of exercise. The correct way to form habits is by providing opportunity for distributed repetitions, accompanied by a feeling of satisfaction. Habits are not formed by repeating over and over again the desire for them, any more than good moral conduct is established as a direct result of listening to sermons or reading maxims.

An important condition in the building of a habit is to have an intense desire for it. The attitude of the learner is a significant factor in habit formation. It is a well-known fact that when adults wish to acquire a new skill such as riding a bicycle or driving a car, they stick to it until they have mastered the technique; but they do so because they wish to become proficient. "Practice makes perfect," provided the element of desire, accompanied by a feeling of happiness or success, remains uppermost in the minds of the learners.

Group approval is an important factor in habit formation. There is an inherent tendency to respond to social approval. This tendency can be used in the building of habits. Everyone wants the approval of others and will work hard at many disagreeable tasks in order to secure this. Social approval and social pressure help us to accomplish much that otherwise would not be done. In the building of correct habits we should be sure that satisfac-

tion attends the exercise. Annoyance or discomfort attending wrong practice may also aid in habit formation. We like to do those things that give us satisfaction. This is known in psychology as the principle of effect.

We should form habits as they will be used. Habit comes only by repetition and exercise of the learner's own nerves and muscles. Just to tell a child not to do something or to do something is not sufficient; it requires more than mere direction. The acquisition of skill — for example, in the fundamental combinations of arithmetic — is a matter of forming correct habits. Memorizing and the acquisition of all skills are nothing more than the formation of habits.

It is action that aids in building habits; it is continued action of the same kind that establishes neural patterns in a definite manner, so that the desired action becomes largely automatic. Life is action, and the value of one's life depends upon the right kind of action. William James, in his notable chapter on "Habit," has the following to say on the building of habits:

Let no youth have any anxiety about the upshot of his education, whatever the line of it may be. If he keep faithfully busy each hour of the working day, he may safely leave the final result to itself. He can with perfect certainty count on waking up some fine morning to find himself one of the competent ones of his generation, in whatever pursuit he may have singled out. Young people should know this truth in advance. The ignorance of it has probably engendered more discouragement and faint-heartedness in youths embarking on arduous careers than all other causes put together.¹

The mind set of the learner is a factor which must be taken into consideration in the formation of habits. The desire to learn and to coöperate with the teacher is essen-

¹ William James, *Talks to Teachers on Psychology*, p. 78. Henry Holt and Company, 1899.

tial. The idea of the act and of the end to be attained facilitates habit formation. When the learner is earnestly intent on the mastery of a skill for ends which he feels or conceives to be of value, the major task of habit formation has been accomplished. A large part of the time spent on drills in such subjects as arithmetic and handwriting or in rote memory work is wasted because of the failure to secure first of all the coöperation of the pupil in the undertaking.

HABITS ARE THE RESULT OF CONDITIONING

Habits are built out of specific elements. When a habit is being formed, there is no reason for believing that there is an automatic transfer to other learning experiences which are in no way related to it. Because a child knows thoroughly that "two plus three equals five," there is no assurance that he knows that "three plus two equals five" or even that " $2 + 3 = 5$." Each new association must receive its due attention in drill. In the early stages of reading, each word or phrase must be deliberately taught. After learning a word in one phrase-setting, a child should not be accused of stupidity if he fails to recognize the word in a different setting.

Knowing well how to do a thing is by no means the same thing as being able to do it. Memorizing a process and actually putting the process into execution are two different habits. After studying earnestly and memorizing thoroughly the directions for operating a lathe, the pupil in a workshop may find himself completely at a loss when standing at the machine for the first time. Being able to pronounce words does not mean that we know the meaning of them or are able to use them. Knowledge of civics does not in itself make the child a good citizen. To attain the latter standard, he must practice being a good citizen.

The years of childhood are the critical ones in habit formation and character building. During this period the child's native tendencies begin to appear in his native reactions and expression of purpose. The child has developed a limited number of nerve patterns. His reactions to a given situation have not been organized into any definite series. In contrast with him, the adult has many well-established associations and behavior patterns. These constitute important factors in his mind set and may interfere seriously with his acquisition of new habits. It is difficult to teach an old dog new tricks, not because he is old but because he has learned his tricks. Childhood habits form the bases for all later ones. If the habits acquired in early life are undesirable, it is necessary to effect a substitution, and this is a difficult and wasteful expenditure of energy. The building of correct habits from the beginning is the greatest economy in learning.

THE USE OF DRILL

In situations where exact knowledge, skills, and attitudes are desired, specific drills are required. The amount of such drill is dependent upon a variety of factors, such as the simplicity of the process, the preceding experiences, the manner of presentation, and the attitude and interest of the learner. Drill means exact repetition without variation of the act to be acquired. The learner must not be shown how to do a thing in one way at one time and then be permitted to do it in a different way at another time when the situation is the same. Pupils should be drilled in the acquisition of skills and knowledge, but not in the solution of problems requiring continuous adjustment to new situations.

The teacher must be concerned not only with the primary fixing of habits but also with the task of keeping the essen-

tial ones active. An effective method of preventing loss of knowledge, attitude, or skill is exercise. It is possible to practice beyond the point of gain; and when drill no longer results in improvement, the energy should be directed into other channels.

It is a mistake to have subjects taught, completed, and then relegated to the past with little reference to them in the future school life of the pupil. After completing the four years of a high-school course, a college freshman may find his ability in arithmetic to be much poorer than it was when he completed the eighth grade. Spelling seldom deteriorates, chiefly because it is a subject of criticism during the years of training in advanced work in English composition and other subjects. Any habit or skill that is not used tends to decrease in its efficiency. The skillful teacher gives systematic reviews for the purpose of maintaining the effectiveness of desirable habits. She carefully avoids those situations which may stimulate an undesirable reaction.

THE ELIMINATION OF HABITS

People say that they are going to break a habit. This is physiologically impossible. Strictly speaking, habit is never broken. One merely substitutes one habit for another. A habit once formed but not used or exercised for a long period of time may suddenly function when the proper situation arises. To illustrate: An individual has learned to drive an automobile with a certain shift. He has exercised this motor performance until it has become a habit. Then he buys a new car with just the opposite shift and proceeds to substitute the motor performance involved in this new shift for the old one. He practices it very many times until he feels that he has become proficient and automatic. But at some unguarded moment of excitement or

confusion the original habit functions: he makes the wrong shift, and the car reverses instead of going ahead.

The substitution of habits probably requires a greater expenditure of effort and energy than was necessary for the formation of the original habit. This holds true for habits of thought and attitude as well as for those which involve skill. If you do not desire a habit, do not form it; if you do not want an act to become habitual, do not exercise it.

INDIVIDUAL DIFFERENCES IN LEARNING

The practical teacher requires no extensive treatise to establish the fact of individual differences. She becomes aware of differences among pupils when she first stands before her class. Each pupil shows distinctive characteristics in features, dress, and behavior. Aside from the differences between boys and girls, marked especially in voice, bearing, and attitude, other differences are apparent. There are the short and the tall, the frail and the strong. There are some who appear happy and spontaneous; others are moody, self-conscious, and irritable. Some coöperate well and are cordial; others are distrustful, resentful, and even rebellious. As the work of the year proceeds the teacher recognizes more and more clearly that the pupils differ widely in their reactions in the classroom. Some are conspicuous for their ability, others for their inability, to grasp the fundamentals. No two pupils are found to be absolutely alike in any particular.

Significant problems for educational procedure arise from this diversity among pupils. How to make education fit the greatly diversified needs of groups and how to bring the pupils who show such diversity into a progressive and somewhat unified mastery of fundamentals are problems which relate to the whole field of educational theory, methods, and

administration. The school must provide opportunities for the full development of the abilities and individualities of all pupils. Individual variation is an asset.

CAUSES OF INDIVIDUAL DIFFERENCES

All differences between individuals may be explained by the facts of heredity, environment, and learning. A child may inherit an unusual keenness of vision. Environing circumstances, such as a bright light, extreme strain, or an accident, may result in defects of vision, or special training may enhance his ability to recognize objects which are barely in sight. One's present abilities are the results of many factors. These cannot be analyzed in retrospect, nor can they be weighed or accurately estimated. No two germ cells are exactly alike. No two developing organisms meet exactly the same conditions in environment and training. There are so many countless combinations of forces that marked individual differences must be the rule rather than the exception.

It is commonly known that twins usually resemble each other more closely than do siblings (those who hold only a brother-and-sister relationship). This may be largely a consequence of the fact that their prenatal as well as post-natal environment has been very similar. In the case of dissimilar twins, the theory is that the two organisms are developed from two separately fertilized ova. The heredity of the two is not identical, although their fertilization may have been coincident. Identical twins are believed to have identical inheritance. As a rule they also have similar environmental experiences.

One of the open questions in educational psychology has to do with the relative importance of heredity and environment as the cause of individual differences. It is very difficult to find a satisfactory solution to the problem,

since both are essential factors in life, and one does not exist without the other. It is impossible to turn back the pages and determine what anyone would have been like if his heredity had been different or if he had been subjected to a different set of circumstances. Two coördinate "sciences" have developed, eugenics and euthenics. The former has to do with the discovery of laws controlling heredity, or "good birth"; the latter is concerned with the problem of providing the right environment or training and is an important function of education.

THE RANGE OF INDIVIDUAL DIFFERENCES

While recognizing the many differences which are physiological in character, such as height, weight, bodily structure, and strength, educational psychology is concerned with differences in mental behavior. Physiological differences are considered only as they relate to the mental life.

It is surprising that the facts of mental differences were not recognized long ago. It was commonly assumed that the mind was a supernatural gift to every person, each receiving the same amount and quality. Before the beginning of the nineteenth century, children were often regarded as miniature adults and were expected to show the same interests, manners, and capacities as their parents. Even after differences caused by age were recognized, the marked variations among children of the same age were scarcely suspected. Ebbinghaus, the psychologist who made the first important research in the field of memory, seems to have assumed that what was true of him would be true of the rest of mankind. The child who failed in the mastery of a subject was held to be morally culpable for his deficiency. The schoolmaster who held an apple in his left hand, as a reward for success in the recitation, and a bundle of switches

in his right hand, as a penalty for failure, was a symbol of the educational method of his day.

Children differ in both mental and physical characteristics. Such differences may manifest themselves very early in the life of the child. One will respond to outside stimuli by movements and noises much earlier than another. Some will learn to speak simple words and to walk within the first year of life, whereas others may not attain these skills until much later. The time between the stimulus and the reaction varies greatly for different persons. The sense organs of some are much more sensitive than those of others. The ability to handle language forms in increasing complexity appears to be a distinguishing characteristic of some children. The type of imagery which individuals use most readily is worthy of note: some are inclined to be ear-minded; others are eye-minded or motor-minded; while the great majority of individuals use several types of imagery. Images are probably very clear in the mental life of some, but are vague and indefinite in others. There are many who develop remarkable powers of free imagination or of reasoning; others make but little progress.

The differences in the mental ability of individuals may be even greater than the differences in specific traits. Mankind is classified into groups according to the amount of mental ability. One classification often used is that of genius, very superior, superior, above average, below average, inferior, border-line, and feeble-minded. The last class is often broken up into moron, imbecile, and idiot groups, in descending order of intelligence. Children of the brighter groups find it easy to make rapid progress through the entire range of educational institutions, from the kindergarten to the university, whereas others are so deficient mentally that they cannot take the first step in formal education. The strictly feeble-minded type seldom progress

beyond the primary grades, and the border-line group have difficulty beyond the third or fourth year of school work. Only those who are at least average are able to finish the regular secondary-school course, and the college and university are still more selective.

AGES OF CHILDREN IN EACH GRADE¹

GRADE	AGES													Total	OVER AGE	PER CENT OVER AGE
	6	7	8	9	10	11	12	13	14	15	16	17				
1	117	187	49	9	3	4								369	65	18
2	2	153	201	47	23	5	1							432	76	18
3		2	116	219	86	27	10	2	1					463	126	27
4			18	112	169	78	37	22	7	1	1			445	146	33
5				6	80	150	85	57	27	11	4			420	184	44
6					6	80	114	85	59	24	6			374	174	47
7						6	66	114	107	65	12	1		371	185	50
8							4	47	107	96	30	5		289	131	45
Total	119	342	384	393	367	350	317	327	308	197	53	6	3163	1087	34	

The age-grade relationship shows the amount of retardation of some pupils and the acceleration of others as compared with those who are in the grade which normally corresponds to their age. The age-progress table is a graphic method of portraying these relations as they exist in a school system. The table shows that there are 369 pupils in the first grade. Of these, 117 are six years old, and 187 seven years old. These are spoken of as "at age," since pupils are allowed to enter only when they reach the age of six, and many are nearing seven when they enter. There are 65 who are "over age," that is, older than should normally be the case. Of these, 49 are one year retarded, 9 are two years retarded, 3 are three years retarded, and 4 are four years retarded. Assuming that pupils should progress by a grade each year, heavy lines are drawn to indicate the

¹ Adapted from H. O. Rugg's "Statistical Methods applied to Education," p. 343. Houghton Mifflin Company.

at-age groups throughout the various grades. It is noteworthy that comparatively few children are "under age," because the schools have given more attention to retarding the backward child than to advancing and accelerating the brighter child.

The overlapping of pupils in the various grades is another outcome of differences in pupils. The ordinary promotion plan assumes that when the child is advanced into the seventh grade he is a year ahead of any pupil beginning the sixth grade in his ability in the various subjects. But repeated investigations have shown that his status in a standard test may be as low as any in the sixth grade, or lower; in fact, lower even than that of some of the better pupils in the second grade.

THE LEARNING CURVE

The progress made in learning may be shown graphically in a learning curve. There is no typical learning curve. The learning curve for sensorimotor learning, in which chief attention is given to motor adjustment to stimuli, is very different from the curve which represents problem-solving or memorizing.

The learning curve may be given several different forms, a marked distinction being made between the time curve and the work curve. In the former, as shown in Fig. 9, the vertical scale is in terms of successive trials. The curve here shown represents progress made by an experimenter in mirror-drawing. A relatively large amount of time (153 seconds) was spent on the first trial before the task was completed. On the second trial the time was greatly reduced. The third trial does not yield as good results as the second, but the progress from this time on is evident, with a marked decrease in rate of improvement after the

sixth trial. The curve is concave, with a descent from left to right. In this curve the time is variable, but the work done on successive trials is constant.

The work curve shows the increase of work done when the time on successive trials is constant. The horizontal scale is the same as in the time curve, but work units are now

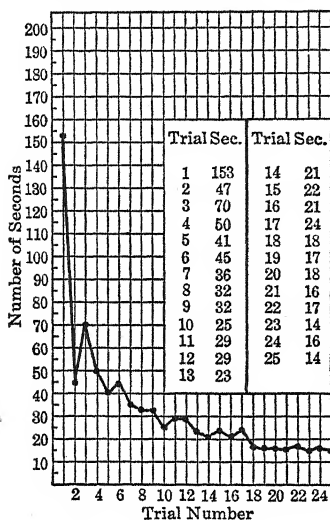


FIG. 9. Time curve

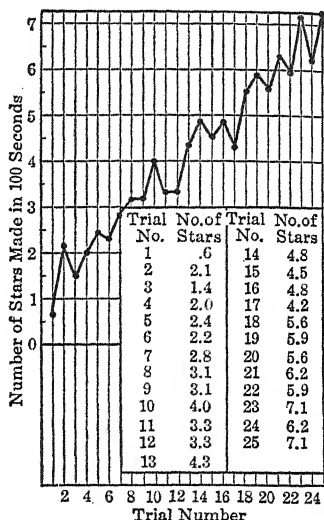


FIG. 10. Work curve

placed on the vertical scale. The time-curve data may be converted into work-curve relations, or vice versa. The facts of Fig. 9 are here transmuted into data which are graphically presented in the work curve of Fig. 10, which shows how many stars would be made in each trial of 100 seconds in length. At the rate of work done in the first trial $100/153$ of a star would be made, or 0.65 of a star; on the second trial $100/47$, or 2.13 stars; and so on for each trial. It is evident that the two forms of learning curve require different interpretations.

These curves are typical of the progress made in learning a skill in which new processes must be mastered. The curve for problem-solving is usually very different. A puzzle may engage the learner's attention through a long period without result. Then when it is solved the learning process is immediate, and in a very few trials the learner approaches perfection.

The curve of error is highly significant (especially when considered in connection with the learning curve) as a means of determining the influence of speed upon accuracy, or vice versa. When errors are recorded for each trial, they may be graphically represented on the same diagram as the learning curve by constructing an independent vertical error scale at the right side of the diagram.

In most individual learning curves an irregular progress is noted from one practice period to another. A steady progress is the exception. This may be the result of a large number of factors. Success in any trial may be the outcome of chance elements which may not be duplicated in the next trial. The attitude of the learner may vary from trial to trial. In one trial he may place the emphasis, whether deliberately or not, on speed, and in the succeeding trial on quality. The degree of concentration of attention is a most significant factor in progress. It is difficult for the learner to control this factor.

Studies of learning curves in functions involving skills show that there is a tendency to rapid progress at the beginning, with a later falling away in rate of progress. This is commonly explained by the fact that a new task has the appeal of novelty, which wears off with fuller acquaintance. In the case of concentrated effort through a long period the falling off may be an evidence of fatigue. It is also true that the beginnings of any skill may involve many simple elements or items which are already well known, needing

only simple reorganizations which can be quickly and easily made.

As the learning proceeds, plateaus in the learning curve are often evident. These are periods covering few or many trials in which apparently no progress is being made. Doubtless they are critical periods, in which it is easy for the learner to become discouraged if he is aware of his lack of progress. In view of the fact that the plateau is usually succeeded by a marked rise in progress, some regard the period as a sort of breathing space, in which the learner prepares himself for a new outburst of energy. Evidence seems to point to the fact that it is a period of assimilation, in which the learner gathers together all that he has thus far learned, eliminates the superfluous and confusing elements, and selects and gains a somewhat automatic control of the essential phases. It is very encouraging to a learner to know that continued effort at this stage will be rewarded by a later period of progress. In this sense the plateau is not a period in which no advance is made. It is possible that the plateau is a characteristic that is not necessary. It may be an indication of poor method, which can be eliminated to advantage as the learner is given the opportunity to assimilate as fast as he learns.

Seldom, if ever, does an individual attain the upper limit of his potentialities. When a machine is being used, as in typewriting, the learner may be limited by the mechanical adjustments of the machine. The present world record in this skill would have been an impossibility a decade ago because of the inadequacy of the machines then available. Another limiting factor is the physiological organism. In stenography the upper limit of the learning curve is set by speed of the writing movements. There is no way of prophesying the limit of the human mechanism. World records in athletic contests are made which appear to be the limit

of achievement, only to be succeeded by later superior records. Other factors that determine the upper limit of progress are one's attitudes or particular interests, his innate or acquired abilities, and special methods which are applicable. A man may surprise himself and others by rapid progress, gained through supreme effort or varied techniques, after his limit appears to have been reached.

In general, the rate of progress becomes less as the learner approaches the theoretical limit of his undertaking. It is evident that relatively greater credit should be given for a unit of progress made in the more advanced stages of the process than for the same unit made in the earlier and easier stages. More effort is required to increase the high-jumping record by a half-inch beyond the mark of six feet than was required to increase by the same amount beyond three feet.

GUIDING PRINCIPLES

Other things being equal, the greater the number of practices the more permanently fixed will be the learning. Drill in some form is essential to the mastery of fundamental skills in school subjects. This is the secret of all habit formation, and it operates according to the law of exercise. Practice does not increase the sensitivity of the end organs nor the retentiveness of the nervous system; neither does it increase the capacity. It merely gives, through developing habits of attention, greater facility in the use of what one possesses and gives more highly organized associations. Another principle of learning is found in the fact that those things tend to be best and most readily learned which provide satisfying outcomes to the learner. It is for this reason that many different kinds of incentives have been devised to accompany drill processes. The chief value of motivated learning lies in the fact that it puts the learner

into active relations to the task. An item or a group of items may be thoroughly stamped in the memory because of its association with a very disagreeable situation, but in general the learner tends to avoid all experiences which are unpleasantly associated. A curiosity in threatening prospects may be exhibited, but this interest aids in avoiding the danger; hence it does not lead toward a learning of that which will make the threat more real, but rather toward ways in which it may be evaded. This is also a phase of the law of effect which must be taken into account.

Another condition closely related to that of interest and effect is the condition of understanding, or comprehension. One may be inclined to learn material which is incomprehensible because of the desire to rid himself of his ignorance, but he soon loses interest unless after prolonged effort he finds some meaning in this material. One learns more quickly and permanently the material in which a definite meaning is perceived. When nonsense material is presented for memorizing, the learner attempts to establish some artificial associations, even though he is unaware of any deliberate effort to do so. The learner should understand the significance of the material he is to learn and should connect this material definitely with previously acquired knowledges and skills.

In addition to providing an adequate number of drills to fix the task in mind, the trials or practice periods should be timed so as to produce the best results. Very little is known as to the best distribution of drills in the various subjects of the schoolroom or in other activities. In general, however, it is known that the drill period for the younger children should be relatively short, not over ten to fifteen minutes. This is because of the fatigue attributable to the effort which young children must make in concentrating their attention for any length of time. This is especially

true if the drill tends to inhibit free activity. It has been further discovered that the same amount of learning time, distributed over several periods of about twenty minutes each, tends to give better results than would be the case if the practice were all concentrated in one long period. This would vary greatly with subject matter, interest, age, and other conditions.

The moment that specific learning ceases, forgetting begins. It has been discovered that forgetting is most rapid at first, with a gradual diminution later on. This suggests the necessity for continuing drills after the subject matter has been learned, and spacing such drills so that they will be of lessening frequency. It is possible through long periods of disuse to retain much that has been learned. Relearning may be effected quickly. It is possible that even after practice has ceased one continues to learn without being aware of it. It is more likely, however, that the intervening period has given an opportunity for the elimination of interfering associations. In this sense forgetting certain things is of distinct value to learning. The student of shorthand may find, after a summer's vacation, that many of the processes are clearer in mind and more automatic in control than before practice ceased. It is in this sense that James speaks of learning to skate in summer and to swim during the winter.

The ease with which one forgets depends largely on the degree of mastery that has been attained. Material which is memorized beyond the threshold may be retained for many years.

That learner will generally make most rapid progress who is free from dominating inhibitions. Perhaps no worse start could be made than for an initiate to have his mind full of many things which he must not do. Positive emphasis, which leads naturally to the substitution of new,

desired practices for old ones, is by far the best policy. The awkward youth who is learning to dance becomes more awkward when he is made aware of his lack of grace, and for the time being his progress is slower. The reason for this is that inhibitions are very distracting. They prevent the attention from clinging constantly to the subject in hand. Any lack of concentration interferes with the progress of the learner.

Rhythm is often found to be an aid to learning. The time rhythms of movement aid in the learning of a skill, — especially in organizing successive units of movement in relation to each other, — and in speed control. The rhythmic grouping of objects aids in visual perception. In the same way, auditory learning is assisted by rhythmic grouping of stimuli. Memory, either of sense material or of nonsense material, is greatly furthered through rhythmic associations. Most persons are spontaneously rhythmical and are carried along by the rhythm without any sense that it is something foreign to the situation. In fact, the mind may be set free by it so that one can more effectively concentrate on the task in hand.

Emotions may or may not be a help in the process of learning. Too great a play of the emotions may be highly distracting. When the learner is dominated by emotions of great joy, sorrow, or fear, efforts to learn will be found very ineffectual, but there is a proper place for the emotions in all learning. With an adequate and controlled use of emotion it is probable that the process of learning may be made much more effective.

QUESTIONS

1. What is learning?
2. Can there be learning without activity? Can there be any activity without learning?

3. Does all learning require an incentive? Explain.
4. How would you go about forming a new habit? Will the same method be effective with other persons? Why?
5. How can we form a mind set?
6. List five different methods of changing our habit reactions.
7. Explain how the differences in mental ability may be greater than the differences in specific traits.
8. What shall be done with the over-age pupil?
9. To what degree do college students use trial-and-error learning in their studies?
10. How and when does learning take place?

REFERENCES

- COLVIN, S. S. *The Learning Process*. The Macmillan Company, New York, 1911.
- DASHIELL, J. F. *Fundamentals of Objective Psychology*, Chap. XII. Houghton Mifflin Company, Boston, 1928.
- GIFFORD, W. J., and SHORTS, C. P. *Problems in Educational Psychology*, Chaps. VIII, XIV. Doubleday, Doran & Company, Garden City, 1931.
- HOLLINGWORTH, H. L. *Educational Psychology*, Chap. VIII. D. Appleton and Company, New York, 1933.
- JORDAN, A. M. *Educational Psychology*, Chap. III. Henry Holt and Company, New York, 1928.
- THORNDIKE, E. L. *Educational Psychology*, Vol. II, "Psychology of Learning." Teachers College, Columbia University, 1914.
- THORNDIKE, E. L. *Human Learning*. The Century Co., New York, 1931.
- TROW, W. C. *Educational Psychology*, Chap. IX. Houghton Mifflin Company, Boston, 1931.
- WOODWORTH, R. S. *Psychology* (Revised Edition), Chap. IV. Henry Holt and Company, New York, 1929.

CHAPTER IX

THE LEARNING PROCESS (CONTINUED)

Learning consists of changes in the learner. These changes are brought about by either external or internal stimuli which result in some form of activity. The fundamental factor in learning is a receptive, impressionable nervous system. In this chapter we shall next consider other factors which have a physiological basis and which are essential to the acquisition of skills and knowledges. These include attention, transfer, play, and expression.

ATTENTION AS A FACTOR IN LEARNING

Learning is impossible without attention. We are always attending to something during our waking state. There is probably never a time when we are not attending to some external stimuli or condition, or some internal state of being.

The narrowing of the field of consciousness to one item or relation is essential to the acquisition of knowledge or skill. Man can select, within limits, what he wishes to think about and do. In many instances he can choose what he wishes to see and hear. This ability to select from experiences is of educational significance. Selection is a phase of attention. An important factor in learning is the selection of those materials to which attention and practice are to be given. Directive and selective power of attention is evidence of a trained, educated mind. It is an indication of intelligence and control.

Thinking or thoughtfulness involves attention. We are always mentally active to some degree. The degree to which we are attending depends on stimulus and interest as well as on training. When we attend, we are in a state of readiness.

Attention involves the ability to inhibit. When we are solving a problem, whatever it may be, we are excluding from the focus of consciousness those factors or experiences which are not closely related to the central thought. One with a trained intellect can relegate nonessential material into marginal consciousness.

FORMS OF ATTENTION

Various classifications of attention have been made, as: active, passive, primary, secondary, derived primary, voluntary, involuntary, and nonvoluntary. There is but one kind of attention, namely, "active attention." The terms here listed are names of different relations of attention under varying circumstances.

Passive, or free, attention is largely spontaneous and comes into the focus of consciousness without apparent effort. A sudden movement or strange stimuli will produce this physical and mental state. Most of the attention of children is of this nature. Spontaneous attention is similar to the nonvoluntary attention, except that the latter is derived from voluntary attention.

Voluntary attention comes with mental growth and development. Individuals of the lower level of intelligence never acquire voluntary attention. Such attention involves a sense of effort. It requires a background of experiences and the ability to organize these experiences to purposeful ends. It makes possible the selection of the significant and the important. The trained thinker can keep his attention directed toward this end.

Knowledge of these forms of attention is of value to teachers. Upon the free, passive, spontaneous attention we build the active, voluntary, or controlled attention. To develop the latter in children is the vitally important task of educators.

The attention that comes without excessive strain or effort gives the best results. For this reason the life of the child should be free from unnecessary turmoil and distractions. Then all his energy can be expended on the solution of the problem at hand. The aim of teachers and students should be to effect a transition from voluntary attention, which is conditioned by social pressure and duty, to non-voluntary attention, which is conditioned by interest. When this has been acquired, studying becomes fruitful. The end for which students and teacher should strive is free, spontaneous attention on the intellectual level. This is superior to the form of attention based purely on the level of instinctive tendencies.

ATTENTION AND INTEREST

Interest determines the direction of attention. It is closely related to a state of readiness. A feeling of interest is satisfying. A state of readiness and a state of satisfyingness are essential to economical learning. Interest may reduce forced attention to the level of spontaneous attention. Interest does not reduce the amount of effort necessary to perform a task, but it makes even the most arduous activity pleasant. Interest in the successful completion of a special piece of work stimulates greater activity and develops attitudes that are conducive to rapid and easy learning. The boy whose interest in the radio has been stimulated will work many hours making a set. The pleasure that comes from the work makes it satisfying. He is

not aware of the feeling of fatigue. His desire to learn drives him on to further activity, and by this he not only learns readily the skills required but develops attitudes that are wholesome and knowledges that are useful.

Interest aids in the unification of effort, both physical and mental, and helps in the reactions preparatory to learning. In learning, the attention should be centered on the steps to be taken. Interest in improvement aids in detecting errors. The desire to do our work better tends to increase our sensitiveness in the detection of mistakes, and also assists in their elimination. Interest is a state of feeling which accompanies attention. Attention always exists where there is intense interest.

ATTENTION A FACTOR IN ASSOCIATION

There are no isolated mental elements. Experiences must appear in consciousness, and awareness always involves relationships between ideas. Every fact we acquire is related in some way to those that have been learned. This relationship is called association. The ability to retain facts and impressions and then to recall them is essential to learning. To understand any fact it is necessary to relate it to other recalled experiences. We can interpret a present experience only in terms of others we have had. When we relate one fact that we have learned to another fact, we give attention to the relationship. This higher form of attention furnishes the associations that will be valuable in later learning.

The learning of a poem, combinations in arithmetic, the alphabet, or even nonsense syllables requires attention to each individual fact or unit and the relationship between them, so that each is associated with the others. The act of attention results in some degree of activity of the nerve

centers and thus leaves an impression which, when the proper stimulus comes, makes it possible to recall the fact, condition, or relation attended to.

Understanding increases interest and attention. These two conditions make associations easier and more prominent. When we are engaged in the process of attending, we are searching for some particular fact, and in doing so we make contacts with few or many other facts, depending upon the richness of our past experiences. Attention is necessary for recalling, and what we recall depends upon association and selection.

EFFECT OF ATTENTION

Many stimuli which make no apparent impression are not absolutely excluded from consciousness. They are given a subordinate place. Whatever is attended to stands out clear and distinct. Attention increases the clearness of the mental state. Attention may either analyze or synthesize, but in either case the primary effect is to increase the prominence of the whole or of the part.

In analysis, one part of a total process is made prominent, and this makes possible the recognition of its constituents. This can be illustrated from music. In listening to a chord one hears the complex of notes, but by an analysis of the chord each component part is made prominent, one after the other. A child, when first learning to read, sees a word or a group of words as a whole, and it is only later that he analyzes a word or words into their constituent letters.

By synthesis the clearness of the mental state is increased. It differs from analysis only in that the total effect of the mass is attended to rather than some one component. It unites the elements into a single whole.

By analysis or synthesis we effect sensations, memory,

or thought processes. Attention enables us to analyze a perception into its sensory and meaning elements.

Our ability to select and organize certain facts, conditions, or problems from experiences determines to a large degree our mental efficiency. In a state of attention the mind is focused upon one particular item, and because of this we are able to accomplish in a short period of time many more things than would be possible if only a state of indifference or casual attention existed. Sustained attention is a characteristic of the efficient individual.

Increased attention not only gives clearness but also intensifies thinking and enables one to do many tasks and to solve difficult problems that at first appeared to be beyond his ability.

ATTENTION IS SPECIFIC

It has been said by untrained observers that we can attend to many unrelated units or configurations at the same time. This is not a fact. It is possible to attend to but one idea, condition, or pattern at a time. It is possible to do more than one task at a time, provided one or all of them be habitual. We attend for a brief instant to one condition or thought and then pass rapidly to another. It seems as though we were attending to many different things, when in fact only one condition or object or pattern is occupying the focus of consciousness at any one moment.

Voluntary attention to one object can be sustained for only a brief period of time, a few seconds at most. Rather than allow attention to be diffused, one may direct it to various aspects of the same object or task so that different relationships may be considered. This principle should be of special interest to teachers. Children should learn to attend to all phases of a problem. This is an aid to understanding. If a pupil learns to direct his energies logically

in problem-solving, he may be better able to solve related problems in life situations.

The tendency for the attention to shift will result in endless fluctuations unless special precautions are taken. This tendency to fluctuation comes with such regularity that it is spoken of as rhythms of attention. We do not always yield to these tendencies. Effort is necessary to keep a thought in the foreground of consciousness. This power to exert effort and to arrange our mental content in such a manner as to utilize it is a distinctive trait of man. The prime function of education is to aid the individual to develop the ability to keep a thought in the center of the field of consciousness long enough for it to be viewed, analyzed, understood, and acted upon.

CONDITIONS OF ATTENTION

Attention may be conditioned by the nature and intensity of the stimulus, and it may come without any desire or warning. Attention may also occur contrary to our wishes. The individual often attends because he cannot do otherwise. The characteristic of some stimuli and the general nature of the environment are such that he cannot avoid noticing them. If we ask why we attend to some condition or object at a special time, we find the answer in the environment or in the individual, or in both.

The circumstances of the individual and of the outside world have much to do with the conditions of attention. The underlying causes of attention are to be found in the antecedents of the attending process in the individual himself and the material that the outside world offers. If we attend to events which will occur in the future, we have a state of anticipation or projection. These are significant factors in imagination.

Attention may be aroused by external stimuli. The quality, intensity, size, and duration of a stimulus and its contrast with surroundings determine whether or not it is likely to be attended to. In any such mental state there is always a series of circumstances in the outside world that precede attention. A strong stimulus—an unusual expenditure of energy, an intense sound, a bright light, a strong odor, or a large object—may force itself into the focus of attention. Change may be more important than intensity or extent in determining the course of objective conditions of attention. These changes, whether in size or intensity, in position or quality, are objective conditions of attention. A flying bird will be observed quickly. The active teacher finds it unnecessary to demand attention from her pupils.

In addition to the objective conditions of attention, there are certain subjective factors which must also be taken into consideration. These subjective conditions give the individual spontaneity and self-expression in the selective process. They reflect his earlier experiences.

Pillsbury, in his intensive study of attention, distinguishes five different groups of subjective conditions as follows:

1. The idea in mind.
2. The purpose or attitude at the moment.
3. The earlier education.
4. Duty (as the expression of social or individual ideals).
5. Heredity.

The first condition, the idea in mind, is very significant in the mental process of attention. We readily notice what we have been thinking about. This may be influenced either by a preceding sensation or by an idea. We see an object more quickly if we have the picture of it definitely in mind. If we look at an object and have some particular part of it in mind, we recognize it much sooner than

if we look without this definite image. A teacher reading an essay and looking for errors in spelling or grammar may fail to appreciate its beauty and content.

The second subjective condition of attention is the purpose or attitude at the moment. This may be aroused by asking questions which will stimulate interests. We are inclined to attend to those things in which we are interested and for which we are looking. The man who goes hunting for rabbits may not see any other kind of game. The purpose gives only a general idea of the class of objects to be expected. Our attitudes change from time to time. They influence the shifting of attention. Our purpose and attitude determine the direction as well as the quality of our attention to the affairs of life. One usually sees or hears what he wants to see or hear. What is done must be in harmony with the intention and purpose; otherwise, there is wasted effort. We are not likely to notice the wall paper in a room unless we are viewing it with the idea of selecting paper for the walls of our house. Man is usually blind to what does not agree with his purpose. This purpose or attitude may be aroused by external or internal stimuli. When aroused from without, it may be owing to a question asked, a task, or a problem presented by someone in authority; when aroused from within, the purpose usually arises by suggestion from something that has been experienced. An external or internal stimulus starts a train of associations. This may raise a series of problems, each problem leading to the next. A definite problem or project is essential to proper observation. The result of each effort of attention is a new thought which furnishes the foundation for succeeding thoughts; and so the thinking process, once started, is continuous throughout waking life, momentary interruptions being the only interference.

The third condition of attention involves the early edu-

cation of the individual. This determines to a large degree the character of his attention, as well as the influence of the attitude stimulated by this attention. A distinct influence of early education is to make attention to certain things more effective than attention to others. It has been said that the American Indian has the native ability to follow paths through the woods, but this is not true; it is the result of early education, training, and interest. Education stimulates many-sided interests and therefore gives an increased power of observation; it determines the stimulus that will be appreciated; and it aids in selecting that to which we wish to attend. What we see or hear may be indicative of earlier experiences. The teacher, upon entering a home, will see that which pertains to his profession. Education increases ability for discrimination. It determines what shall enter consciousness.

The fourth condition of attention has its basis in social life. The attention of the nonsocial individual is conditioned by his personal desires and interests. Social training may hold the attention to that which we do not like. We attend because of social pressure. The gaining of a remote goal may force us to attend to that which is intrinsically less pleasant. Attention to unpleasant situations is often conditioned through social ideals. The environment in which individuals are reared often forces them to attend to useless or unpleasant conditions. Thus attention is often directed towards ends which are unpleasant.

Heredity may be termed a fifth subjective condition of attention. This may well be illustrated by the attentiveness of individuals to other individuals. There is in the life of normal individuals the inborn tendency to attend to the behavior of the opposite sex. The appreciation of art or music is owing, in part, to the tendency to observe certain stimuli rather than others. Many similar characteristics

and capacities must be explained in part by innate differences in attention. The fundamental ways of attending depend upon one's inheritance.

The difference between a good learner and a poor learner is largely one of attention. The good learner is one who is able to focus upon one thing until it has been analyzed and synthesized. A personal interest in what is to be done will aid in securing and sustaining attention. Attention centers upon the significant; and the teacher's chief effort should be to make important activities significant to the pupils.

The process of attention is closely related to the principle of learning called readiness. The learner must be in a state of physical, intellectual, and emotional readiness in order to learn. One or more responses may be made to a given stimulus, but the one most likely to occur will be the one in which there is the least resistance and the greatest state of readiness. This state of readiness usually includes a favorable attitude, or mind set. If the reaction be satisfactory, the attentive state remains pleasant.

The individual whose mental state is favorable for certain stimulation will acquire knowledge or skill with greater ease and will use less time and felt effort than one who is in a state of unreadiness for action. Biologically adequate responses to states of readiness are satisfying; responses forced on an individual not ready to act are annoying. The teacher should be in a state of readiness to teach, and the pupils in a state of readiness to learn. In this intellectual, emotional, and physical state the teacher will be able to stimulate activities that will arouse related response bonds so that productive associations will be established. This will aid both in fixing impressions and in recall.

The state of readiness, or mind set, is directed to particular responses or stimuli. There is no general state of readiness for all conditions. The state of readiness is best

thought of as belonging to a specific response. The response in itself may be complex and involve a number of neural patterns. We are always progressing, or working for some goal, and this desire, wish, or ambition controls in part the processes of the mind.

A state of mental, emotional, and physical readiness aids in preparing the child to attack his problems. This condition stimulates an inner urge to action for a definite purpose. It further helps the child to marshal all his forces for a definite end. When he knows the end to be attained, the feeling of success becomes a determining factor in his drive. When success has been reached, there is a state of satisfaction which is stimulating to further attempts at the solution of difficult problems.

Another fundamental principle of learning is that of exercise. When the physiological, neurological, and mental states of readiness and attention are active, then the pleasant exercise of a physical or mental activity will aid in learning. In other words, the exercise of a function tends to give it permanency and makes possible the proper association and recall of a past experience. Improvement comes from exercise accompanied by a pleasant feeling tone and purposive endeavors. Practice or exercise over a long period of time may result in little or no gain because of fatigue or the loss of interest.

Overlearning or mastery can come only through exercise. Overlearning is an essential principle in education. After a fact or skill has been acquired so that it can be repeated or executed at least once without error, it is then necessary to exercise it several more times for greater retention and permanence. This furnishes the basic principle for drill in the various subjects.

LEARNING THROUGH DRILL

Repetition is essential to the mastery of skills or information. At certain stages of life the child takes to drill as naturally as to any other activity, provided it is properly conducted. The proper amount and kind of drill in tool subjects are essential to the laying of thorough foundations for the whole program of studies.

Much effort in learning is inefficient because it is not definitely directed to specific ends. Definite attainable goals should be set. It is a common error to teach a subject matter as such, instead of developing in the pupil the specific abilities necessary for educational progress. Handwriting is taught by daily formal drills imitating some model with the view of developing legibility. No two of the pupils in a classroom have exactly the same difficulties; all differ in their degree of mastery of specific abilities. The demand for greater stress on individual instruction or on grouping according to needs is apparent. The waste involved in teaching every pupil all the words in a spelling lesson, without reference to individual needs or difficulties, is tremendous.

The activity of the study period should be directed to the acquisition of skills and information to be used later. In spelling, words should be mastered which will be used in the writing vocabulary of the individual. There is waste in the common practice of spending time and effort in formal drills with ovals and "push and pull" lines of penmanship when the same controls that are sought could be secured through drills with actual written forms. The child learns specifically that which he practices.

The length of the period of drill should be taken into consideration for the different subjects and ages. Time spent in excessive length of drill at any one period is wasted. Rest

periods should be timed to meet the needs of the growing and active child. Intensive drill for a comparatively short period is found most effective. All drill must take into account the law of diminishing returns. In the learning of any function there comes a time when a further unit of effort does not result in a corresponding unit of return.

The law of exercise or repetition is most effective when there is a modifiable connection and the exercise of the connection is desired and satisfying. The mere repetition of a condition does not produce learning; the other factors must be kept constant, such as satisfyingness, desire or purpose, frequency, and interest in the act as well as in the outcome. The keeping of a pupil in after school hours to write a misspelled word correctly a hundred times is no assurance that it will be learned. The ability to attend and inhibit are factors to be considered in every learning situation.

The strength of a connection does not depend solely upon exercise or repetition. The principle of belongingness or acceptability is important. By belongingness is meant that there are common factors in situations and that the relationship contains identical elements. The greater the degree of belongingness, the greater the strengthening of the connections, without regard to the number of repetitions. In teaching, the element of belongingness should be emphasized, and thus blind repetition be reduced.

TRANSFER OF TRAINING

What is the effect of learning in certain specific fields on the mental development in general or on the ability to act more efficiently in other fields of work? Does it make much difference what subjects a student pursues in high school or college so long as he receives good instruction?

Is the training the child gets in the study of one subject useful in his study of other subjects? To what extent is there transfer, if at all?

The doctrine of formal discipline asserts that mental ability, however gained, may function in any department of human activity. That is to say, the theory states that mental power developed in one subject is usable in any other. Some have thought that the more difficult a subject is, the more mental power is developed, and that, consequently, difficult subjects should have a large place in the school curriculum.

The original doctrine of formal discipline was based on "faculty psychology." This psychology held that the mind was composed of many faculties, such as perception, memory, judgment, reasoning, will, attention, and imagination. It was thought by some that these faculties were more or less independent of each other and could be improved by training. Thus, a language drill or learning "by heart" useless as well as useful matter was asserted to be good in training the memory, and mathematics was thought especially suitable for the development of reasoning power. This theory of "mental faculties" has long been abandoned by the psychologists.

The modern theory of mental functions regards memory, perception, attention, and reasoning, not as separate faculties, but as aspects of the total reaction to a particular situation. These mental functions are not faculties but phases of the total adjustment of the individual. In learning one reacts to some situation. What one learns is the resultant of the reactions. Training *does not* produce a *general* improvement of memory. Whatever improvement is brought about comes as a result of better methods of attention, recall, or recognition. The techniques involved in this improvement will apply to other acts of memory

and may also be effective in many of the complex mental processes in which the same activities are present. This holds true for all complex mental processes.

THE EXPERIMENTAL EVIDENCE

Modern laboratory methods in psychology have made possible a solution of the problem of transfer. Experiments carried on in the latter part of the nineteenth century showed results that were greatly at variance with the popular view. It was found that the amount of transfer was relatively small. It is not surprising that the early techniques were more or less defective and that the results were misinterpreted. The view that the doctrine of mental discipline was incorrect and that training in one subject would not contribute to all others became prevalent in educational circles.

It is not necessary here to discuss all the experiments that have been made in this field. It will be enough to show something of the nature of the investigations and the results secured.

James's personal experiment in memory was the first attempt to investigate this problem. He concluded from his study that training memory in a given subject had little or no effect on memory for other things. Since then many experimental investigations have been made. Thorndike and Woodworth studied the transfer of the ability to make special judgments and found little if any transfer. Bagley made a study of neatness under school conditions and with school subjects. He found that pupils who were trained in neatness in their arithmetic papers showed no improvement in neatness in connection with their geography work. However, when neatness was made a conscious ideal, there was general improvement.

All the investigations show general agreement on the following points:

1. That there is some transfer of training where common identical elements are involved.

2. That transfer is generally far from complete.

3. That the amount of transfer varies with conditions, such as habits of attention, similarity of content, intelligence of the learner, attitude toward the task, methods of learning, and methods of teaching.

There has been disagreement in regard to the amount of transfer that is possible and also in regard to the explanation of the facts found. One of the best experimental studies of transfer of training, from the point of view of the number of persons examined and the real life situations involved, was conducted by Thorndike in 1922-1923. Over 8000 children were tested. These children had no knowledge of the test that was being made. They were practiced in their actual school work. The function that was tested with a view to detecting transfer was the power to obtain high marks in portions of the Institute of Educational Research Intelligence Test. The children were given the tests both at the beginning of the school year and at the end. Naturally they improved their scores on the second occasion. The question was whether some of the school subjects had improved their ability more than others.

From all the pupils under examination, two groups were selected who were taking the same school subjects with one exception; for example, one took Latin where the other took cooking. Any differences between the two groups could be attributed to these subjects.

Suitable precautions were taken to insure carrying out the experiment as scientifically as possible. Perhaps the chief objection to it would be that the tests were artificial and unlike real-life tests; that is, they were short and had

to be performed within a time limit at a certain place and on a certain occasion.

In this experiment Thorndike established the fact that transfer is not easy to detect, as it would be if it occurred to a large degree.¹ In 1927 he repeated many phases of this study and obtained results that were in essential agreement with his earlier findings. His conclusions are not in opposition to the theory that general improvement of intellectual functions results from school studies, and that studies vary in their value in this respect. The disciplinary theory was that the amount of transfer or general improvement was large, that some subjects were much more important than others in this respect, and that mathematics and the languages were especially significant in disciplinary values. Thorndike's results indicate that the amount of general improvement owing to subjects is small, and that the difference between them in mental discipline or transfer values is relatively small. The meaning of these results may be made clearer by the following example: It was found that a year's study in either algebra or geometry as now organized does increase one's ability to think in a small degree, but that the gain is no larger than that attributable to the study of other subjects under similar conditions. Bookkeeping, biology, cooking, and sewing increase the ability to think as much as the study of mathematics or the classics, and in some cases even more. In respect to disciplinary values, the physical sciences are equal, if not superior, to the languages and mathematics as they are now taught.

In view of these results, it is obvious that the values of school studies are to be found largely in the special informations, habits, interests, attitudes, and ideals which they

¹ E. L. Thorndike, "Mental Discipline in High School Subjects," *The Journal of Educational Psychology*, Vol. XV (1924), pp. 1-22, 83-98.

demonstrably produce, and not in the mental-discipline values as such. Furthermore, other things being equal, one subject is about as good as any other subject as regards its value for the general improvement of the mind.

THE JUDGMENT OF PSYCHOLOGISTS

The psychologists who contributed to the symposiums on transfer of training in connection with the Classical Investigation and the Committee on Mathematical Requirements under the auspices of the Mathematical Association of America expressed the opinion that under certain conditions mental functions are subject to transfer. As was pointed out above, this indicates a very marked change in opinion from that current a quarter of a century ago. Many of the psychologists expressed the opinion that the transfer of mental functions to other fields is slight. Practically all of them, including those who believe in some automatic transfer (that is, without conscious adaptation of content and method to this end), are agreed that the amount of this transfer can be increased when favorable conditions and methods are provided. Of these, the majority expressed the opinion that conscious generalization is essential or desirable. This means that if considerable spread is to be assured, the common element to be transferred must be brought specifically to the child's attention in the generalized form of a principle, and the application of the principle to other fields must be emphasized and made clear. The chief problem of transfer is that of so organizing the method of learning that it will carry over in the minds of the students to other fields.

The general conclusions drawn from the questionnaire submitted to the psychologists and from the comments which some of them added may be stated as follows:

1. The two extreme views for and against disciplinary values practically no longer exist. As the question now stands, the psychologists almost unanimously agree that transfer does exist.

2. A large majority of the psychologists agree that there is a possibility of negative transfer and of zero transfer, caused by interference. Thorndike is of the opinion that negative transfer is comparatively rare and can be avoided by proper methods of training.

3. Very few if any experiments show the full amount of transfer between fields chosen for investigation.

4. The amount of transfer in any case where transfer is admitted at all is very largely dependent upon the methods of teaching. (This is probably the strongest note emphasized by the psychologists in their comments.)

5. Transfer is most evident with respect to general elements, ideas, attitudes, and ideals. These act in many instances as the carriers of transfer. Often they form the common element so generally held to be the *sine qua non* of transfer. About half of the psychologists express the opinion that special training in connection with these elements has general value.

HOW TRANSFER TAKES PLACE

Many theories have been proposed to explain how a change in one mental function may produce changes in other mental functions. Thorndike's theory of identical elements has been one of the most popular views. It can best be stated in his own words:

The answer which I shall try to defend is that a change in one function alters any other only insofar as the two functions have as factors identical elements. The change in the second function is — in amount — that due to the change in the elements

common to it and the first. The change is simply the necessary result upon the second function of the alteration of those of its factors which were elements of the first function and so were altered by its training. To take a concrete example, improvement in addition will alter one's ability in multiplication because addition is absolutely identical with a part of multiplication and because certain other processes — e.g., eye movements and inhibitions of all save arithmetical impulses — are in part common to the two functions.

Chief among such identical elements of practical importance in education are associations including ideas about aims and ideas of method and general principles, and associations involving elementary facts of experience such as length, color, number, which are repeated again and again in differing combinations.

By identical elements are meant mental processes which have the same cell action in the brain as their physical correlate. It is of course often not possible to tell just what features of two mental abilities are thus identical. But, as we shall see, there is rarely much trouble in reaching an approximate decision in those cases where training is of practical importance.¹

The identical-element theory of Thorndike is based on the hypothesis that learning consists in the establishment of specific bonds or connections between various specific elements; consequently, one form of learning influences another whenever bonds established in the former may also be used in the latter.

The theory of generalization has long been championed by Judd. He writes:

The important psychological fact . . . is that the extent to which the student generalizes his training, is itself a measure of the degree to which he has secured from any course the highest form of thinking. One of the major characteristics of human intelligence is to be defined by calling attention . . . to the fact that a human being is able to generalize his experience. James

¹ E. L. Thorndike, *Educational Psychology*, Vol. II, pp. 358-359. 1913.

has discussed this matter by using the example of the animal trained to open a particular latch. The animal becomes acquainted with the necessary movements to open one door, but he never has the ability to generalize this experience. He cannot see that the same method of opening doors is applicable to many other latches. The result is that the animal goes through life with one particular narrow mode of behavior, and exhibits his lack of intelligence by his inability to carry this single type of skill over to the other cases which are very familiar to the trained human intelligence.

James goes on to say that the same distinction appears when we contrast a trained scientific mind with the ordinary mind. The ordinary thinker does not see how to deal with a situation in terms of scientific principles. James cites the example of his own experience with a smoking student-lamp. He discovered by accident that the lamp would not smoke if he put something under the chimney so as to increase the air current, but he did not realize that what he had done was only one particular example of the general principle that combustion is favored by a large supply of oxygen. The general principle and its useful application belong to a sphere of thinking and experience which the untrained layman has not yet mastered.¹

The theory of generalization attempts to explain transfer of training or the spread of improvement in terms of a conscious recognition of the fact that experience obtained in one connection may be applicable to other connections. Thus, habits of sustained attention, orderly procedure, and perseverance, ideals of accuracy, neatness, and thoroughness, and such general attitudes as annoyance at failure and satisfaction with success experienced in one situation are applicable to other situations.

The configuration, or Gestalt, theory of transfer emphasizes that the whole is something more than all of its parts. According to this view, not common elements but their

¹ C. H. Judd, *Psychology of High-School Subjects*, pp. 413-414. Ginn and Company, 1915.

form, pattern, or organization determines the presence or absence of transfer from one situation to another. Transfer of learning from one situation to another results from the application of a certain principle of configuration. First some elements and then some others come to acquire a place in the situation and to enter into its configuration as members. To the extent that this occurs, there is transfer.

PRACTICAL CONCLUSIONS IN REGARD TO THE TRANSFER OF TRAINING

The fact of transfer is no longer doubted. The spread is usually not so great an amount as the adherents of the formal-discipline hypothesis thought and not so small or negligible as some believed a quarter of a century ago. The amount of spread is not the same in all cases. It is usually far from complete transfer. Its nature may be positive or negative. The amount of transfer is dependent upon many factors, such as the manner in which the subject is taught, the attitude of the learner, and the similarity of the content in one field to that in another.

There are certain practical conclusions which are obvious, regardless of whether the results are due to the functioning of identical elements (Thorndike), to the generalization of experience (Judd), to training which results in the acquisition of a definite functional value applicable in other situations which have certain general characteristics in common (Koffka), to generalized habits, training of attention, effective use of mental imagery, the development of attitudes and ideals, the technique of learning, and concept of method, or to all of these.

The first practical conclusion is that the teacher who knows how to teach and how to make use of materials in any course can render this subject or activity broadly

productive in other fields and activities, contrasting in this respect with the teacher who teaches only the formal aspects of the subject. Formalism and lack of transfer are not so much characteristics of the branches taught as they are the results of particular uneconomical methods of teaching.

The second practical conclusion is that the teacher should make the pupil conscious of the activities which he wishes to transfer. The teacher must not assume that transfer will take place automatically. The more the teacher works for transfer, the more likely is her procedure to be effective. Bagley, in his doctrine of transference through ideals, would acquaint the child with the significance of ideals and their general bearing.

The third practical suggestion is that the teacher should stimulate and guide the children in making as wide application as possible of what they acquire. It is not sufficient to call the child's attention to the trait, habit, or attitude that actually produces good results. There must be a conscious generalization of these attitudes or traits into general habits or aims. The desirable elements to be transferred should be made the object of thought and be generalized. Their application should be amply illustrated. If the pupil is made conscious of the possibilities of spread of improvement, more transfer may be secured.

Transfer, even in small amounts, is worth while if it is applied to many activities or functions.

PLAY AS A FACTOR IN LEARNING

Play as a learning reaction. Experience derived from the senses and from motor reactions constitute the basic elements of mental life. Through his sensations the individual comes to know the qualities of the world; through his motor relations he organizes these qualities into units and

systems of thought. Attitudes and relational thinking largely depend on motor responses. The motor reactions called play are characterized by their freedom and spontaneity. They are the most valuable of all forms of motor activity in the process of learning. The young of all animals play and have always done so. Play is the chief business of the young. This holds true for all races and for every species of animal life. This tendency to play has persisted through the ages and in recent years has received special attention because of its educational and development value. With a keener realization of the significance of play has come a broader interpretation of education in its relation to knowledge, morality, and art. Play is the great synthesizing, integrating, and developing force in childhood and adolescence.

In playing his hunting and tagging games, the child develops his entire being, including motor skills, sound digestion, good circulation, emotional attitudes, sportsmanship, and intellectual judgments. Although we may be unable to trace the exact connections of the preparatory value of hunting games with the activities of modern life, there can be no doubt of their relation.

An important fact, and one not sufficiently stressed by writers in interpreting play activities, is that these activities furnish an exercise for the responding mechanisms, which gives the development needed by the organism at the various age levels.

What is play? Play, in its final analysis, is "an attitude of mind." It is the attitude of the individual toward the response that determines whether the activity is work or play. What is work at one time may be play at another. There is a gradual change in the complexity of the play activity as the child grows older. The child at six years of age may have his desire for a boat satisfied by a little piece

of wood floating on the water; at ten he scorns the simple piece of wood and demands sails and rudders; at sixteen he is absorbed in constructing a motor boat. The play activity that satisfied at six or at ten may make no appeal at sixteen.

In play activities the impulse to act and the aim are correlative parts of a satisfying process. The effort expended in reaching the goal is satisfying, because it is the natural process involved in realizing the aim. The capacity to work or the capacity for sustained effort is developed normally in play and other purposive activities. Children, as well as adults, play because such spontaneous activity satisfies certain natural cravings. It is part of their original nature and an activity they must engage in to develop normally. The attitude and the feeling tone of the individual while engaged in an activity determine whether the activity shall be called work or play. This attitude may be the result of some external force or of an ideal which is the outgrowth of past experience. No clear-cut line of demarcation can be established between work and play. The variations within the human being are too numerous.

Play and work activities in organic development. Out of the activities of the child comes his intellectual power, provided he has intellectual potentialities which may be developed. He engages in all kinds of activities, each activity making its contribution to the sum total of his intellectual life. The "big muscle" activities are either play or work, according to the attitude of the individual. These activities satisfy a felt need. Children ought not to be forced into physical activities that are organically annoying or harmful. The child responds in vigorous physical activity with the same intensity and satisfaction that he does in the more dominantly mental activities.

The development of body parts and organs is facilitated

by suitable play. The play activities stimulate the vital processes to healthy activity under most favorable conditions. Health, strength, physical endurance, and resistance to fatigue are all direct results of a free and complete play life.

Carr sums up the value of play responses in child development as follows:

First: Play reactions are easier than those of work because they involve the oldest and most used centers.

Second. Play brings a greater amount of activity because it is easier, more pleasurable, and less fatiguing than work.

Third. The intensity of response is greater because attention is undivided and spontaneous, and therefore interest is keener.

Fourth. Play is a better stimulant to growth and development than work because it meets nature's demands in a natural and timely way.

Fifth. Play is the most variable of all reactions and thus provides constant and suitable exercise for all important physical and mental activities.

Work has usually been interpreted as mental activity, and play as physical activity. The fallacy of this is self-evident. School programs have usually divided the activities of the school into the subject-matter courses, such as reading, writing, and arithmetic, and called these work. Play has long been identified with the "big muscle" activities of the playground. Mental activity is as genuinely satisfying as physical activity and may be just as purposive, or playful. Physiology and neurology teach that responses involve nerves as well as muscles and glands, and that there is no magic by which physical and mental activities can be separated. The child undoubtedly thinks the moment he realizes the relationship between a bump on his head and the pain that ensues. One activity may involve more thinking than another or be more dominantly motor. Play

activity may represent either extreme. The contemplation of electrons, the conduct of a political campaign, the solving of a cross-word puzzle, the construction of a water wheel, or even a game of baseball, may be play or work, depending on the interest or attitude of the particular individual.

Imagination and play. Imagination is a vital factor in learning. Play provides a free outlet for action through imagination. Through imagination the child, as well as the adult, may interpret a toy as fitting into a play situation at one time and into a work situation at another time. Play keeps the child active, and through his actions he will gain in skill and bodily coördination. The essence of play is the happiness that comes from the activity.

The tendency to play may find its outlet in purely motor responses, as when the child romps and shouts with glee; or it may find its outlet through perceptual responses, as in the solution of puzzles. Similarly, memory and imagination may furnish the outlet, as when the child plays store or school. These make possible the pleasure and happiness of playground, home, and classroom. The realization of the value of play activities and their effective direction are essential to good teaching. To use to advantage the possibilities involved in play activities requires exceptional skill in teaching.

EXPRESSION AND LEARNING

The one single function of the nervous system is to enable the organism to act. Nerve tissue and mental processes have for their function the stimulation and control of action in accordance with the organism's need, wants, or cravings, Sensations, perceptions, imaginings, feelings, reasonings, and memories and are of value not only for their own sake but also for producing and controlling action. The entire study of responses to stimuli shows the presence of continu-

ous activity throughout life. It has long been an acknowledged fact that there is no impression without expression. The child learns by means of expressions as well as through his sense impressions. He is not a mere passive recipient of impressions, but he reacts to these impressions by forming habits and patterns of responses. He learns his reactions by reacting.

Relation of impression and expression. The nervous system is so organized that it is possible to receive stimulation that will make an impression. This impression is greatly aided by expression such as the drawing of a map, the writing of an essay, the mechanical manipulation of figures in solving a problem. All leave their impress and aid in establishing neural patterns. The very act of drawing a map strengthens the impression of the map in a way and to a degree not obtainable in any other way. The child who recites his lessons gains what he cannot secure by listening to the recitation of others. The greater part of a pupil's time in school should be devoted to desirable forms of expression.

The educative value of expression must not be overlooked. Clear, concise, and accurate thinking correlates with corresponding qualities of expression. When expression is given to a thought or fact, impressions are reënforced. Expression is not only a testing device; it is also a learning and teaching device as well. Every act of expression in turn makes its own impression on the mental life of the learner. A successful reaction may and should lead to another successful reaction.

Types of expressive activities. In the spontaneous type of expression the individual is in a more or less passive attitude, and the attitude takes place without any intention or desire on his part. The random fingering of objects on the desk or the pencil in one's pocket belong to this class. The child

makes many more movements of this type than adults. The accumulation of nerve energy requires an outlet, and this type of spontaneous activity furnishes the means. The proper adjustment between accumulated nerve energy and its motor outlet becomes one of the most difficult problems of classroom control.

Another type of expressive activity takes place as the direct result of the stimulation of the sensory end organs. These activities may be instinctive, habitual, or deliberative. The individual may not be able to control some acts, while others are the result of intelligent choice of action.

Many acts are the result of emotional impulses. In this type there is no deliberation or choice. There is an idea of the end to be attained, and this is accompanied by a group of appropriate muscle movements. These emotional acts may be the cruelest and most debasing as well as the bravest and noblest acts of men.

The deliberative types of expressive activity are most valuable. Emotions and feelings do not control these acts. They are purposive acts. The direction is determined by judgment and reasoning, with a definite end in view.

Among the significant forms of action which may be classified under these types are imitation and the expression of meanings. The spontaneous and reflex types of imitation and the expression of meaning may be of little value in classroom work; on the other hand, impulsive and deliberate acts of imitation or meaning are of the greatest importance in systematic education. A child learning to talk begins with spontaneous and reflex vocalization. This is followed by impulsive efforts to imitate the sounds made by his teacher and finally by deliberate efforts. Thus he acquires a tool for future expression. Out of the spontaneous reflex scribbling of the baby comes the finished product of the penman. All forms of expressive activity have their

roots in native equipment directed toward the imitation of the activities of others. These expressive activities culminate in deliberate self-expression. Deliberate acts may develop into habits and skills through the application of the laws of habit formation. Self-expression may show itself either in interpretation or in creative effort. Interpretation deals with the treatment of materials already organized; creative effort is concerned with the new organization of old materials or with the organization of new materials. The pupil who recites a poem may merely repeat the words in imitation of the teacher, or he may interpret it according to his own understanding. He may produce a new poem through his own creative effort.

Expressions and emotions. There is a high correlation between the intensity of any emotion and the intensity of expression. The education and control of the emotions is accomplished largely through the control of their expression. The expression of desired emotions is encouraged until it becomes a habit.

The expression of ideas and emotions is a natural, or in-born, tendency. The reason why adequate expression is so frequently lacking is to be found in the development of inhibitions. Self-consciousness is one of the most potent forms of inhibition. This interferes with one's normal ability to give expression to his ideas. The ease, clearness, and effectiveness of a child's expression on the playground or in the home may be in painful contrast to his laborious and cumbersome efforts in the classroom. The initial step is to put the learner into a pleasant state of readiness to learn, and to remove and avoid any stimulus that will produce self-consciousness or fear. A child learns most readily under the influence of the pleasant emotions. Recognition of accomplishments and approval by teachers and fellow pupils produces a pleasant feeling and is a great

stimulus to continued effort. For this reason a pupil often learns more effectively as a member of a well-constituted social group than under private instruction. The stimulus which comes to each member of a group when all are engaged in a common enterprise gives social coöperation a special educative value. The fine art of the skillful teacher is never so clearly shown as when she brings the whole class into coördinated purposeful activity.

RELATION TO EDUCATIONAL METHODS

The measuring rod applied to modern education is that of efficiency. Whatever other claims may be made for a method of teaching, its advocates must, above all, be able to prove that it is economical of time and effort. Waste is as greatly to be deplored in processes of learning as in any other aspect of life. The demand for economy means that the method used shall yield the greatest returns of the best quality in the shortest amount of time and with the least expenditure of energy and money. Such an ideal applied to learning is almost limitless in its possibilities and opens the way for continued improvement in content and method.

The use of improved methods of learning implies wise guidance. The chance discovery of facts and processes is very wasteful. If left to follow his own instinctive tendencies and natural interests the learner may never discover the most effective plan of learning and may fail to grasp an adequate body of information. Experience is a good teacher, but it charges a high rate of tuition. When a child is severely injured by an automobile, he has learned the lesson "not to play in the street" much more effectively than he could have learned it by being told or by having read the warning. But it is an expensive lesson. Those who have had experience or who are capable of conceiving

experience may make it real to the child. Such reality may be effected by vivid description and by bringing the learner to imagine himself in the situation.

The attention of educational leaders has shifted from the teacher to the learner. Exclusive consideration of the instructor has given way to the necessity of getting the learner's point of view. The basis of educational content and method is found in the capacities, attitudes, and abilities of the one taught. The educator finds it essential to adapt himself to these factors. The question How to teach? cannot be satisfactorily answered until it is definitely known how children learn. Thus the learner becomes the center of interest and study. This study makes use of all the methods of modern science. It involves a great deal of systematic observation of children, for the most part statistical and experimental. The results of various factors have been compared as applied to the learning process. One has only to compare books on educational method published near the end of the nineteenth century with those of recent date to note how the dependence on statistical and experimental evidence has increased.

There are three well-defined points of view relative to methods of teaching. The first is a passive acceptance of traditional methods without inquiry as to their validity or fitness for particular situations. The second is of a higher and more progressive type, because it is at least critical. It makes a logical study of the learning process and attempts to build up an organization of method which is sound as judged by adult introspection and reasoning. Its chief defect lies in the fact that the child himself supplies no data. The whole plan may be evolved without any reference to the learning process of the pupil. The third point of view is in contrast to the others in being primarily psychological. It does not invent a method based on abstract

theory, but undertakes to develop one through scientific observation of the child. Such analysis discovers the most economical procedures. This point of view is experimental. All methods are tested, and are accepted tentatively until they are proved sound by actual practice. They are gladly surrendered when better methods are discovered. The improvement of method has come as a result of increased knowledge of human nature and institutions.

The evolution of method in the teaching of reading in its first stages is a vivid illustration of the contrasting influence of these three points of view. The traditional method was first to teach the alphabet as a whole and to teach the sounds of the various letters as they were presented. The letters were then combined to make words, and these words were carefully spelled out and pronounced. After generations of such practice a new and very logical method developed, that of teaching by syllables. The syllable "at" was taught, and then combined with various sounds to make words: "cat," "mat," "sat," "that." With the addition of a few other symbols the child could now be led to read "That cat sat on the mat" and other artificial combinations. Only a few years ago the psychologist discovered a better way to teach reading. This consists in leading the child to proceed directly to the perception of thought units and their meaning without analyzing the words into syllables or letters. Phonetic drill may be given in a supplementary way, and the alphabet is taught after the child has learned to read. The older emphasis on exclusive oral reading has been found very wasteful and unnatural. As a result a greater emphasis on silent reading has become the prevailing practice. Methods of teaching school subjects, such as arithmetic, history, geography, and many others, have had a like development. Educational methods are constantly evolving, and further progress awaits psychological research.

THE INITIATIVE OF THE LEARNER

Learning should be self-initiated. This is largely a matter of interest. The task which is imposed on the learner when he is not aware of its need or value must struggle against one or more competing interests. The learner may go through the routine of drill without complaint and yet find little if any progress or satisfaction in so doing. The teacher can plan the task and at the same time skillfully lead the child to conceive of it as his own and to give his full assent to it. The sense of personal responsibility should persist through all phases of the undertaking. In no phase is this need more clearly demonstrated than in the examination. A complete reorganization of the plan and the administration of all types of tests is coming about so that pupils will welcome and may desire them as essential parts of the learning process. When this is done, the pupil works in coöperation with the teacher and no longer suffers the inhibitions arising from fear, worry, and aversions. The child who has initiated his learning activity is anxious to know what progress he is making in relation to the progress of others or to his own past record.

The learner should trace his own progress and criticize results. This principle involves not only the examination but also the daily work. The young child who is learning to construct the letter forms in handwriting offers a problem to the teacher. Some teachers attempt to help by grasping the child's hand or arm and guiding the pencil in the circuit of the forms. This procedure is a waste of time. The child must feel within himself the motor strains associated with success and the correction of error. This experience cannot be gained through external control. The same criticism may also be made of the plan of having letters grooved in a board.

Valuable use is made of standard tests and scales in this connection. Graphic forms are placed in the pupil's hands so that he may record his score in the test, may draw or extend the line of progress, and may note where he stands in relation to the norm, the average of the group, and his own past scores. The process becomes a pleasure as any gain is noted, and takes on all the interesting characteristics of a game. Children need careful guidance in making such comparisons lest they draw wrong conclusions.

Interest should be regarded as a means of securing the development of certain abilities. It is apparent that the pupil who repeatedly approaches a task with a certain mental set or attitude is becoming habituated in this attitude. The student who enjoys the work in connection with the various subjects is on the way to effective study and learning. In the same way ideals of leadership, social coöperation, and integrity may be fostered or discouraged by relations with the teacher or with fellow pupils. Vocational preferences and abiding interests in certain types of subject matter are the outcome of a well-conducted program of learning.

SOME BASIC CONSIDERATIONS

In learning skill in any function one must take into consideration the relative values of speed and accuracy. These are two variables which often interfere with each other. Excessive emphasis on one has a tendency to limit the other. The two should be brought into harmonious relationship so that they will progress together. Primary emphasis should be placed on the quality of the work. After the proper accuracy has been attained and basic habits have been made automatic, speed of work may safely be emphasized. It has been noted that rapid learners are the most efficient.

The quality of their work is in general on a higher level than is that of the slow learner. This arises largely from the fact that the one who learns rapidly is more intelligent, is better able to concentrate, and may use better methods of receiving impressions and forming associations.

At every point in the learning process, provision must be made for individual differences. The physical condition of the learner is very significant, since it has to do with the effectiveness of the sense organs, the normal functioning of the nervous system, and the amount of distraction or interference caused by pathological conditions. The past habits of the learner must be taken into account. These habits may be favorable or unfavorable to progress in the projected task. Preliminary tests may reveal the learner's chief excellences or weaknesses, so that emphasis may be properly placed. Care should be taken to prepare the learner to see that the transition from old habits and attitudes to desired ones is properly accomplished. The degree of intelligence possessed by the learner is highly significant. Those with greater mental capacity may start out at a higher level than those of lower rank and will be even more widely differentiated from them as the learning proceeds. A distinction must be made as to subject matter and type of function. The dull child may make as rapid progress in lower levels of certain skills as the bright child. Individual interest has also much to do with the relationships.

Learning should always proceed from the psychologically simple to the complex. The new or unknown material must be arrived at naturally by attention to intermediate steps. Certain functions may appear simple to the adult which are complex and confusing to the child. To the adult the logically simple step in beginning drawing is the construction of straight lines. The next step is the making of curved

lines, and then the combination of these lines into squares, circles, and other geometrical designs. The small child, however, naturally draws representations of things, drawing an inextricable mass of straight and curved lines. The result may not be recognizable to the adult, but it is eminently satisfying to the child. The complex stages of future progress of the child in drawing lie in a process of simplification, in which lines are eliminated and controlled until they come to be in a closer relation to the object that is being drawn.

It is seldom that either the inductive or the deductive method is exclusively used in any learning situation. By inductive method is meant that the learner gradually passes through experiences which are so organized as to lead him to an appreciation or a formulation of an abstract idea, concept, rule, or definition; by deductive method is meant that the abstract idea is first stated, then interpreted, and many subsidiary facts are derived from it. It is clear that some generalizations must be taken at face value. Deductive learning has its place. In the great majority of instances, especially with children, the inductive method is the most productive, since it adheres to the psychological method of going from the known to the unknown by connected steps and of obtaining general principles through a study of particular cases.

In all learning situations where behavior is readily observable, as in the learning of a skill, imitation may be of great service. It serves as a means of motivation and guidance. The learner sees that the act can be done. This gives confidence and provides a challenge.

Imitation is not a simple psychological process. Care should be taken that the imitation be in the same space and time relations as those in which the learner naturally thinks. Understanding should not be neglected when imi-

tation is employed. Every imitative act should be weighted with meaning and understanding.

Learning is an active process. The child learns to do a thing by doing that thing, not by memorizing the rules or by watching others. Practical application of what is learned is the best assurance of continued interest and permanence of retention. A lesson is learned only when it can be given adequate expression in words or deeds.

Learning is an activity that involves the formation of connections or associations. Man is the great learner because of his unlimited number of possible neural connections. He is largely the product of his learning. Habits, skills, knowledge, standards of value, appreciations, prejudices, attitudes, and ideals are the outcomes of learning.

QUESTIONS

1. How can learning consist of changes?
2. List ten factors involved in learning.
3. What is the relation between attention and intelligence?
4. How can attention be a selective process?
5. Explain how a state of readiness can be a state of attention.
6. Is there a relation between attention and motor expression? Illustrate.
7. In what way can attention be a factor in association?
8. Name the psychological factors essential to effective drill.
9. To what degree should we depend upon transfer?
10. In what way can play be a learning reaction?
11. Expression is essential to learning; what is essential to expression?
12. Outline the way in which each of the laws of learning — readiness, exercise, and effect — may be used in a learning situation.

REFERENCES

- CARR, H. A. "The Survival Values of Play," in *Investigations of the Department of Psychology of the University of Colorado*, Vol. I, pp. 1-47.
- GIFFORD, W. J., and SHORTS, C. P. *Problems in Educational Psychology*, Chap. VIII. Doubleday, Doran & Company, Garden City, 1931.
- PYLE, W. H. *The Psychology of Learning*. Warwick and York, Baltimore, 1928.
- THORNDIKE, E. L. *Human Learning*. The Century Co., New York, 1931.
- THORNDIKE, E. L. *Educational Psychology*, Vol. II. Teachers College, Columbia University, 1913.
- THORNDIKE, E. L. *Fundamentals of Learning*. Teachers College, Columbia University, 1931.
- WHEELER, R. H., and PERKINS, F. T. *Principles of Mental Development*, Chaps. V, VII, VIII, XIV, XV, XVI, XVII, XVIII, XIX, XX. Thomas Y. Crowell Company, New York, 1932.

CHAPTER X

SENSATION AND LEARNING

There are many factors both physiological and psychological that contribute to the acquisition of knowledge. In the final analysis all the elements of knowledge are derived through the sense organs. Sensorimotor learning requires sense organs, sensory nerves, connecting nerves, motor nerves, and reacting organs. These form the sensorimotor circuit. Many of these circuits are partially established through heredity. A large part of animal learning and the learning of young children is of this type. This type of learning well illustrates trial-and-error learning, or, better still, trial-and-success learning. In order that learning may result, it is essential that we have functioning sensory end organs, connections, and reactors.

A sensation arises when a physical force or substance, acting on one of the specialized end organs of a sensory nerve, produces a sufficient amount of activity in the cortex of the cerebrum in which the sensory or connecting nerve ends. The physical force or substance is called the stimulus. The stimulus arouses a nerve impulse. It may be chemical, as in tastes and odors; mechanical, as in touch and sound; a bodily condition, as in hunger and thirst; or radiant energy, as in light and heat. Each sense organ responds to certain forces or substances, and to no others. Every end organ has its own specific work to perform and has an original equipment enabling it to perform that task, and that task only. In general, the doctrine of "specific energy of sensory ends" has been so far demonstrated that it is be-

lieved that such an organ can do only the work which it does do. This can be illustrated by taking the taste buds for sweet, which are located along the tip and sides of the tongue. They are not stimulated by light waves nor by sound waves nor by most chemical substances, but they are stimulated by cane sugar, glucose, saccharin, and to a slight extent by alum. Any substance that stimulates this sense organ tastes sweet.

When the sense organ has been stimulated, it in turn acts upon the sensory nerve to which it is attached. The nerve impulse travels along the nerve track until it reaches the cerebral cortex. Sometimes the path is very simple and direct, as in the case of the olfactory nerves; sometimes it involves several intervening nerve units and passes through a number of lower centers before reaching the cortex, as in the cases of touch and pain. It is a common error to say that the sensation moves along the nerve, for what is actually conveyed is a nerve impulse.

Every sensation has quality and intensity. This is the only way that we can tell the different sensations. There are as many kinds of sensations as there are kinds of sensory end organs. The occipital lobe gives the color sensations of red, yellow, blue, green, black, white, or combinations of these. The auditory area in the temporal lobe gives the sound sensations, ranging from the deepest bass to the highest treble. Other organs of sensation are the cutaneous, which give us touch, heat, cold, and certain sensations of pain. The sensations of taste are sweet, sour, bitter, and salt. Olfactory sensations give us elementary odors, which are now recognized as spicy, flowery, fruity, resinous, foul, and scorched. Motor sensations, or those from each muscle group, seem to have individual qualities. Organic sensations include those of hunger, thirst, dizziness, fatigue, and certain pains. The qualities of sensations must not be iden-

tified with their use. The same red quality may serve to indicate danger, ripe fruit, or perspective, according to the other factors with which it is associated. The meaning of the sound "aye," "I," or "eye" varies with the relations into which the sensations enter. It is believed that these relations are just as much a part of experience as are the sensation qualities. In mental development the blend of many sensations precedes the recognition of specific elements. This recognition results only from analysis.

INTENSITY OF SENSATIONS

It has been stated that quality is one of the characteristics of a sensation, and intensity another. Each quality of a sensation may vary greatly in intensity or strength. When a sensation is so weak or so fine that it is just barely perceptible, it is at the "threshold"; when it increases in intensity to the point where further increase is impossible or unnoticed, it is at the "acme." Among the factors or conditions that modify or control the intensity of sensations are the following:

1. The sensitivity of the sense organ.
2. The adjustment of the sense organ.
3. The strength of the stimulus.
4. General and local brain conditions depending upon sleep, fatigue, health, drugs, and blood supply.
5. Expectant attention.
6. Inattention, or concentration elsewhere.

SIMPLE SENSATIONS AND COMBINATIONS

A simple sensation is the awareness of a single quality such as pain, blue, sweet, without any other sensations or experiences of any kind attached to it. It is possible that very young babies may experience simple sensations, but

it is certain that after the first few experiences all subsequent sensations arise in combinations. These combinations take the following forms:

1. Blends, where two or more sensations arise as a single undifferentiated experience.

2. Percepts—sensations or blends with a “fringe of meaning.”

3. Feeling-tones—sensations or blends or percepts with accompanying attitudes of feelings.

Blends. A number of sensations that have been experienced frequently together blend into a combination in which the individual sensations can be isolated with great difficulty. Tones, overtones, and musical chords are examples of blends. Red, blue, green, and yellow are simple colors. Purple and violet are blends of red and blue. Peacock is a blend of blue and green. Orange is a blend of yellow and red. The blends of colors are called hues. Blends of black and white form grays. The blend of a color or a hue with white is called a tint, while the blend of a color or a hue with black is called a shade.

Space is experienced as a blend of color and muscle sensations, or sound and muscle sensations. Time is experienced as a blend of sound sensations and rhythmical motor sensations or, in some cases, of color sensations and rhythmical motor sensations. Many experiences may be analyzed into sensations and their blends, or combinations. Sensations are the elements of intellectual life. The sensations of sight and of hearing fuse so readily that we seldom attend to them when listening to a visible speaker, but we are sufficiently aware of the total effect. Gesture, facial expression, the flash of an eye, may unite to modify or to emphasize the meaning of words, volume, accent, and modulation used by a speaker. The total mass of sensory experience present at the moment is combined by the

listener into a single act of perceptual recognition and interpretation, and this single act is quite as immediate for consciousness as the responses of the sensations themselves. The presence in consciousness of this mass of sensation is the first stage of all perception.

Sense perceptions. A perception consists of sensation blends and a "fringe of meaning." This fringe is composed of images of past experiences. It is formed through the haphazard experiences of the individual and is the result of a long and bitter struggle of trial and error and success. But in other cases the fringe is organized and built up through the guidance and control of teachers, and forms an important stage in the complicated process called education.

We have percepts of objects, such as apples, horses, buildings; of representations, such as pictures, models, and imitations; or of symbols, as in the case of form of words, maps, and musical scores. Sense perceptions result from related experiences. We obtain percepts through each of the senses whenever they cause us to refer the sensation complex to some external origin. Sensations and their resulting percepts are further complicated by close association with motor processes, for every sensation is related in some way to expression. Reactions may be considered the culmination of sensory impulses.

Feeling-tone. In feeling-tone we have sensation blends, or percepts in combination with an attitude or a feeling. A disagreeable temperature or a pretty picture may give rise to feeling-tone. The feeling-tone for chocolate candy may be quite different as one approaches the bottom of the box, although the taste sensations remain unchanged. This attitude or feeling is dependent upon the relation of sensations to the organic states. Sensations associated with activities determine the direction which the activities take and furnish a basis of interest, attention, and motivation.

DEFECTIVE SENSE ORGANS

Contact with the outside world comes as a result of the proper and effective functioning of the sensory end organs. Whenever an end organ does not function, there is an interference with the acquisition of knowledge. Most of the sense organs function automatically almost from birth.

Two of the most important sensory end organs from the standpoint of the school are the visual and auditory. It is through these that most of the knowledge is acquired. This makes it imperative for the teacher to detect any symptoms or disturbances in the working of these organs. Special attention should be given to each of these organs at the opening of the school year. Wherever there is a defect, it should be remedied at the earliest possible time.

From twenty to thirty per cent of the school population suffer from defects of vision. This is a most serious problem; and such conditions as size of type, amount and direction of light, distance from blackboard and book, should receive the utmost care, for to neglect them is to interfere with learning. A sense defect may, and usually does, arouse emotional antagonism, resulting in maladjustment and dislike of school work.

The following are the most common defects of vision: myopia (nearsightedness), hyperopia (farsightedness), strabismus (inability to control in an effective way the muscles controlling the movements of the eyeball), astigmatism (poor focusing, resulting in blurring), and color blindness (inability to distinguish certain colors).

Many of these common defects may be corrected by the use of glasses. Care should be used in selecting the proper lens, and in seeing that changes are made as the child grows older. This requires the services of a medical specialist trained in this type of work.

The greatest sensory defect, as has been stated, is found in the vision of school children. The second has to do with hearing. Perfect audition is as rare as perfect vision. Probably only from 2 to 10 per cent of the school population have serious defects of hearing. All children should be tested for auditory acuity. Defects may be pronounced or slight and may be corrected by medical help.

While defective vision interferes with proper interpretation of space relations, so auditory defects interfere with the proper interpretation of sounds. This will result in errors of association, of sensitivity to musical stimulation, and of musical memory and imagination, and in inadequate development of musical intellect and feeling. Most learning and communication require adequate functioning of the sensory end organ of hearing. It is of vital importance that this sense be properly trained. Many speech defects can be traced to defective hearing.

The training of the senses has been a problem for educators throughout the centuries. Locke, Rousseau, and others held that the end organs could be trained. What we train is attention rather than the senses. In the schools much work is, and should be, given involving the use of the senses. The modern motion-picture machine, especially with the sound attachment, is a valuable aid to learning. It is well if more than one sense can be used in the acquisition of knowledge.

IMPORTANCE OF SENSATIONS FOR LEARNING

1. All knowledge can be traced directly to sense experiences. Failure to recognize and to use this principle causes many difficulties of both pupils and teachers. The function of the teacher is to furnish the stimulus for desirable experiences. We are the sum total of our experiences.

2. The first stage of learning involves sense perception. The order of procedure is from facts of sense perceptions to abstract truths and general principles. The study of every subject calls for laboratory methods whereby the learner establishes first-hand contact with his subjects. He should have experience with maps and charts, pictures, globes, and whatever tools are necessary to stimulate activities. To see and to handle are far better than merely to listen.

3. Generalizations and abstractions are not objects of sense perception. Any attempt to attach sensation to an abstract idea or to picture a general principle involves substituting a symbol for the truth, with disastrous results so far as the truth is concerned. On the other hand, concepts and principles give the richest and widest meaning to sensations.

4. Absence of certain sensations as, for example, sight or sound, offers a serious but by no means insuperable obstacle to education. As a rule substitutes develop, and the learning process is accomplished by making more effective use of the remaining senses.

5. Defects of sight or hearing frequently make the pupil appear stupid or backward. The child may not be aware of his handicap, and school authorities and teachers must examine pupils for any abnormality of the senses; otherwise, defects, even blindness in one eye, may remain undiscovered.

6. An individual may have a favorite sense through which he is certain he can learn more readily, even though he has no evidence. Some are convinced that they are eye-minded: they not only imagine and learn in terms of sight, but use their eyes in preference to the other senses in studying, observing, or learning. Others think that they are ear-minded: they may not fully grasp the meaning of words when seen, but comprehend the same words if heard. Another group believe that they are motor-minded and that

the most satisfactory and useful knowledge is secured by handling and doing. Probably the normal person who is good in one sense is equally good in all senses. His preference of one sense over another may be caused by early and accidental habits of learning, by imitation, or by instruction of teachers. A child may be eye-minded in spelling, ear-minded in music, and motor-minded in geography and arithmetic. Even smaller differences may exist, as when he is ear-minded in multiplication, eye-minded in addition, and motor-minded in subtraction.

7. Sensations play an important part in the control of our movements, especially in the control of our physical activities or skills. The kinæsthetic sensations furnish the cues in the execution of movements in handwriting, dancing, piano-playing, or the playing of golf. Sensations must be considered as primary, unanalyzable data. Mental content depends entirely on that which is received through the senses. The sensitivity of the sense organs and the way in which they function are therefore of vital importance, especially in the early years of life.

SENSORIMOTOR LEARNING

Much has been written about sensorimotor learning. This type of learning requires sensory stimulation which results in movements, habits, or skills.

The first evidences of learning are the sensorimotor responses. The development of intelligence is related to the development of this type of reaction. The ability to adjust to the ever-changing environment depends upon the capacity to react to situations and to keep information received through the sense organs for future use in directing behavior. It also depends upon the possession of a muscular system involving many motor combinations. One of the

evidences of learning is the individual's ability to adjust to new and complex situations.

The development of the sensorimotor mechanism is essential to the development of intelligence. It is an accepted fact that children who have developed motor skills have also good intelligence. Motor skills are not a criterion for intelligence; but intelligent individuals usually display some motor skills, or at least are able to develop them. There is evidence that motor activity and experience contribute to intellectual ability and growth.

Many of the measures of intelligence of young children are tests of the sensorimotor learning. Such tests as reaching for seen objects, imitating sounds, marking with a pencil, using a spoon in eating, copying a circle, removing wrapping from food before eating, are of this type.

From the standpoint of motor learning, the value a sensation has is that it initiates the movement. Skills come as a result of the integration activities. Motor skills are acquired through activities on the playground and in the gymnasium, industrial arts, sewing, handwriting, piano-practice, and countless other forms of motor responses.

Motor coördination is a valuable asset in the development of a personality. Good coördination reduces fatigue and enables the individual to use his strength more effectively. Fatigue tends gradually to decrease the motor output and in turn interferes with intellectual development. Poor motor coördination indicates need for training in the specific activities involved, as in handwriting, drawing, dancing, and other motor drills. Judgments of movements are usually poor because of the lack of training. Too little is being done in establishing effective connections between such sensory end organs as eyes and ears and the muscle senses. There is evidence that the eye is trained at the expense of the muscle sense.

EXAMPLES OF SENSORIMOTOR LEARNING

One of the simplest examples of sensorimotor learning is found in the motor responses of animals, as the case of the cat or rat finding its way out of a maze. Trial-and-error reactions on this level are found in the behavior of all animals and children. Trial-and-error movements are resorted to by adults whenever new motor adjustments are required. In learning of this type there is usually little evidence of reasoning; it may be classified as impulsive behavior. The outcomes of this kind of behavior may be habits. Habitual responses in animals and small children come as a result of activities started by a sensory stimulus and ending in a motor reaction. A typical experiment of this kind of learning for adults is offered in mirror drawing. In tracing the outline of a star or circle while looking at the reflection of it in a mirror, movements which are the opposite of the habitual actions are used.

Handwriting also is a form of sensorimotor learning. The accuracy of the sense percepts determines to a large degree the motor outcomes. Handwriting is largely a skill, and sensorimotor connections are essential in the acquisition of this skill. The same holds true of typewriting: to become a good typist, it is necessary to have proper coördination between the sensory or ideational stimulation and the muscular responses involved in the essential movements in striking the keys.

All learning requires action, especially directed action. The organization and guidance of motor actions to bring about desirable responses is a large part of the task of teaching. Handwork, laboratory exercises, physical-education exercises, and many other activities are basic to the higher forms of intellectual development.

QUESTIONS

1. How is attention related to sensation?
2. What are the elements of mental life?
3. How do feelings differ from sensations?
4. How is the feeling-tone related to learning?
5. What constitutes a perception?
6. How many percepts may we have?
7. What is the relation between motor ability and intellectual achievement?
8. Give classroom examples of sensorimotor learning.
9. How can the school develop the various senses so that the child may learn more and retain more?
10. Has sensorimotor learning a biologic basis? Explain.

REFERENCES

- DOCKERAY, F. C. General Psychology, Chaps. VIII, IX. Prentice-Hall, Inc., New York, 1932.
- FREEMAN, F. N. How Children Learn. Houghton Mifflin Company, Boston, 1917.
- GIFFORD, W. J., and SHORTS, C. P. Problems in Educational Psychology, Chap. IX. Doubleday, Doran & Company, Garden City, 1931.
- HOLLINGWORTH, H. L. Educational Psychology, Chap. XIII. D. Appleton and Company, New York, 1933.
- SKINNER, C. E., and others. Readings in Educational Psychology, Chap. X. D. Appleton and Company, New York, 1926.
- TROW, W. C. Educational Psychology, Chap. VII. Houghton Mifflin Company, Boston, 1931.

CHAPTER XI

PERCEPTUAL LEARNING

The physical basis of learning involves the sensory end organs, the sensory nerves, the cortex of the brain, the association fibers, the motor nerves, and finally the effectors. To start a nerve impulse over the above-mentioned circuit does not insure either learning or motor skill; it is merely the physical foundation of learning. The intellectual side of the learning process involves the giving of meaning to the sensory experiences.

The outcomes of sensory experiences are called perceptions. Whenever a sensation is interpreted and given meaning, we have a perception. Every perception consists of one or more sensations or a blend of sensations, together with ideas and images of previous experiences which give meaning to the sensation. There is also an attitude or feeling-tone which is attached either to the sensation or to the meaning, or to both. Every perception is based entirely on present or past sense experiences. Whenever this experience is limited or faulty, there is a corresponding defect in the perception. The errors of perception arise from two causes: errors of sensation and errors of interpretation. Errors of sensation may be illustrated by color blindness, as in the case of failure to distinguish between a red danger signal and a green safety signal. The second type of error in perception is more frequent by far, as in familiar illusions relating to space and time.

A perception always refers to some definite thing or condition affecting one or more sense organs. It may be the

perception of an external object, such as a chair, or a bodily condition, such as a toothache. It may be the perception of the representation of an object, such as a picture, a wax model, or the imitation of a bird call. It may also be the perception of a symbol, such as a number, a map, or " H_2O ."

The sensation aroused by the object or by the representation or symbol of the object constitutes the sensory core of the perception. The same object may arouse a variety of sensations. We may have the visual perception or the gustatory perception of an apple. The perception of a word may be visual, auditory, tactile, or motor. The deaf can be taught to read the lips of the speaker and to understand what is said without receiving sound sensations. The blind may be taught to read through tactile sensations produced by the Braille type. The click of the telegraph instrument may be heard but not understood. The signals sent out by the Boy Scouts may be seen without getting the meaning.

Learning to read is not primarily a problem of receiving sight and motor sensations, but a problem of providing a wealth of meaning for these sensations. Pupils are found who are slow or imperfect readers because they have never acquired the proper skills of eye movements necessary for effective reading. In conversation with foreigners many have the habit of speaking in loud tones, whereas the difficulty of the foreigner is not owing to failure to receive sound sensations but to his lack of familiarity with the meaning of the words. Unskilled teachers sometimes shout at pupils when they fail to understand. This procedure does not assist the child in his understanding.

THE RELATION BETWEEN PERCEPTION AND LEARNING

All forms of knowledge are based upon and derived from perceptions. The teacher who attempts to give instruction in any school subject without basing it upon perceptions will find that the pupils are merely learning words. Local geography is not measured in terms of distance. It may include Russia if the child has been there; it will not include the Ohio River unless the Ohio River has entered into his experiences. The effective teaching of every subject is based upon the use of the pupil's environmental experiences.

The laboratory method is valuable because it provides opportunities for innumerable experiences. This method has long been recognized in science courses. It should be the method used in reading, grammar, arithmetic, and other classroom activities. If the child's experience with any subject is limited to his textbook, he then has only a book knowledge of the subject.

Knowledge of the same object may be obtained through a number of senses, each sense contributing its own quality to the perception. Visual sensations will give a knowledge of color; auditory sensations, a knowledge of sound; olfactory sensations, a knowledge of odor; and motor sensations, a knowledge of space relations, such as size, form, position, and distance. Motor sensations will give also a knowledge of time relations, such as rhythm, duration, and succession. A child who learns the metric system of distance by merely memorizing the table given in his text is without any real knowledge of the millimeter or the meter. To have a knowledge of the metric system, the child must actually measure objects with these units of measurement.

Perceptions are first of outlines, or wholes, and then the details are added. The child perceives the date on the coin

before he perceives the year of the date. He perceives the words as a whole before he perceives the letters of the word. A recognition of this psychological fact changed the entire procedure and method of teaching reading to beginners. In teaching the perception of a picture or a map or a chemical process, one should direct attention first of all to the outline. In learning, the child proceeds from the outline to the details.

The perception of objects or their representation should come before the perception of symbols. In school work this holds true especially of words, numbers, maps, and musical notes.

When conceptions, ideas, or general notions have been formed, they are employed to give meaning and universality to the perception. The untrained mind sees only the concrete relations in objects of perception, whereas the trained mind will see the same object in abstract relationships. Thus the child should apply the general conceptions of river to the particular river he is studying. He must apply grammatical conceptions to the words perceived in his assigned lesson in grammar. The meaning of the word "note" will not be based upon the sensation of sight or of sound, but on the conception in the mind of the reader. This may be a musical or a literary conception.

The difference between merely looking at flowers and studying them is found in the attempt in the latter case to use certain conceptions of botany to give the flower full meaning. Effort to do this in any subject constitutes study.

FORMATION OF PERCEPTIONS

It has been stated that a perception consists of one or more sensations, together with meanings and feeling-tones. Perceptions gradually emerge or develop from sensa-

tions or blends of sensations. This development requires the proper functioning of the sense organs and the use of selective attention. Attention is useful as a means of selecting the significant features of the object under observation. The second step is the attachment of meaning to the sensations. It involves the recall, through association, of previous experiences. Suggestions made by the teacher or by fellow pupils are important factors. Skillful questioning enables the teacher to arouse past experiences and thus to determine the meaning that pupils will give to a sensory experience. The third element in perception is feeling-tone. This is an important factor in the appreciation of works of art, music, and poetry. Pleasant feeling-tones are essential to effective learning. This whole process is called perception.

The formation of perceptions may be illustrated in the case of a child who is studying a rabbit. He first secures sight and touch sensations from the animal. He notes the smoothness of the fur, the short tail, and the long ears of the rabbit. This is done at the instance of the teacher or through his own independent activity. The knowledge of the rabbit is then developed by means of information furnished by the teacher or by books.

The fullest meaning of a rabbit can come only as a result of contrasting it with other animals, such as the cat or opossum. The feeling-tone of the child toward the rabbit will depend on many factors, especially on the attitude and interest of the teacher and the child's ability to see the relation between the rabbit and his other animal friends.

DIFFERENCES BETWEEN CHILDREN AND ADULTS

The sense perception of children differs from that of adults in several ways. Children have acquired a limited amount of experience. They have only a small background

to draw from. Their discrimination is not developed to any great extent. As a result of the lack of this background of experiences their sense perceptions are not as full, complete, and rich. Richness of perception comes with the accumulation of experiences. Children "see" fairies, ghosts, and hobgoblins largely because they are lacking in experience and judgment.

To be able to perceive clearly, there must be a state of concentrated attention. This requires readiness. The mental state, or mind set, determines largely what is perceived and the degree to which it is perceived. There is a marked difference between children in the ability to use sustained attention. This is an important fact in learning and teaching. The mind set, or attitude, of the learner has much to do with the amount learned as well as the ease with which it is learned.

A slight stimulus is needed to call up a percept for the adult, whereas the child needs a more effective form of stimulation. Children are not sensitive to small differences or changes. Directed attention is necessary in teaching growing children. They must read every word; they must see the details of the map or the picture, to comprehend fully the significance and meaning.

The age and experiences of the individual determine the ability to concentrate his attention. The capacity to attend determines the kind and degree of observation. The span and range of attention of children differ from those of adults. The attitude and purpose of children and adults differ in amount, in intensity, and in kind. Purposeful activity presupposes an attitude, or mind set, conducive to keen observation.

There is a great difference between children and adults in the degree of suggestibility. Adults have acquired the power of inhibition, evaluation, and discrimination. This

makes possible the evaluating of the suggestions received. Children follow suggestions readily because they have not learned to see or to control relationships.

TRAINING IN PERCEPTION

It is through the senses that knowledge of the outside world is acquired; therefore, for perceptual learning the sensory end organs must be in proper condition to function. Imagery is dependent upon impressions previously received through the sense organs, and reasoning comes as a result of the proper organization of these experiences. The amount perceived is determined by the training and preparation of the one who perceives. The perceiving of a cotton plant in all its relationships takes time. It also requires a large fund of information in many fields of related knowledge. Mental facts are interrelated, and many of them are required in order to interpret and understand sense experiences properly and completely.

Sense training, which is attention training, is an important factor in school work. A child may have good eyesight but be unable to see significant differences. Ear training in children involves not only hearing but also the ability to discriminate. The direction of attention to the differences is valuable preparation for future learning. Attention properly directed increases the clearness of the mental state and makes perceptions more effective.

Development in skill and in discrimination results from selective attention and not from mere sense experiences. Guidance is necessary in the proper selection of the objects or the situations to be perceived. A second look, or the habit of verification, is effective in the learning of children and adults as well as in scientific research.

Development in skill and in discrimination will increase accuracy, and interest and attention will determine the

amount and quality perceived. Action in the form of appropriate expression is essential to the training of perception. Real conditions, where possible, are the most effective means of acquiring percepts. Life situations are, after all, the best teachers; but these experiences should be organized and graded in difficulty so that the child may proceed step by step in his learning.

EXPERIENCE AS A BASIS FOR PERCEPTUAL LEARNING

Human experiences begin with birth, and out of these, together with activity, grows mental life. Perceptual experiences are essential for mental growth. Every type of perceptual activity, such as playing, laboratory work, drawing, or singing, adds to one's learned equipment.

Children learn by seeing and observing objects as wholes; later, as they learn to perceive, they are able to analyze into parts, or components.

The ability to perceive is essential to learning. Perceiving is more than observing; it requires determination, the recognition of relationships, and the selection of the significant. Many students see demonstrations given and perceive very little, while others perceive much. The difference in their acquisition of knowledge may be owing to many conditions, such as previous experiences, types of activities, interests, and motives. It is of little worth to perform an experiment and make an observation unless the individual knows what to look for.

CONTROL OF PERCEPTIONS

Each of the three elements in the perception (the sensation, the meaning, and the feeling-tone) is subject to control. This control may be exercised by the teacher or by the learner himself.

The control of sensations is very easily accomplished. This involves first of all the direction of attention toward the significant aspects of the subject under observation. This is accomplished by the direct method, as by using a pointer to indicate the object of attention or by requiring the pupil to draw the object; or by the indirect method, as by employing questions or topics of study as an aid to concentration of attention. Sensations may also be controlled through selecting the object to be perceived. Specimens with which the children may work are provided. These specimens should be simple in form and, if possible, large enough to hold the pupil's attention. Vivid colorings also are an aid to perception. In cases where the objects themselves cannot be brought to the child for perceptions, pictures or models may be used to good advantage. Sensations are controlled also by the use of instruments such as the microscope, the telescope, the motion picture, and the radio.

Attention to the sensations is made easy when there is little distraction. For this reason maps should be greatly simplified and all distracting details should be omitted. Clean blackboards and a quiet schoolroom aid in directing concentrated attention to the object under observation.

The control of meaning is accomplished through suggestion and association. Frequently the teacher will suggest the meaning before the object is presented. She will tell about a poem or a picture before showing it. A visit to a museum or to a historic place is most successful when the children have been adequately prepared beforehand, so that what they see in the course of the visit will have meaning from the beginning.

OBSERVATION AS A FACTOR IN PERCEPTUAL LEARNING

It is generally agreed that learning comes as a result of motor reactions and that we learn by doing the act to be acquired. In order to learn, we must act; we must make the reaction in order that it may become a part of us. The mere reaction, as has been stated before, is not sufficient. There must be insight into the relationship between different parts or aspects of the act. Insight in perceptual learning involves observation, observation of minute facts, details, and relationships between parts and experiences. We learn by manipulation, by handling objects, by experimentation; but this can be hastened where demonstration takes place, where the pupils observe the teacher, and where they see some relationship between parts of an experiment. They will observe some connection between cause and effect. Following observation, there must always be an actual participation and manipulation. Learning comes more quickly where there has been a preparation for what is to be learned, where the pupils are in a state of readiness for what is to come. When this state of readiness is evident, then opportunity should be provided for observation and for the actual doing of the act to be learned. This procedure hastens learning and aids in the establishment of the correct relationship between the parts of the facts or skills to be acquired.

A great deal of learning is by observation. We see the act, give it meaning based on our knowledge and experience, and it becomes a part of us. How much will remain with us will depend upon our activity, interest, and feeling. Every new fact must be connected with a past experience; and if there is a natural and easy relationship, or "belongingness," it will stay with us longer.

The child learns by observation, and the early years of

school life should provide an abundance of materials and experiences to be observed.

Observation relieves the child of the necessity of depending so much on trial-and-error processes. It is a short cut to a great deal of learning. Imitation is a potent factor in learning, but there can be no imitation without observation. We imitate what we have observed in one way or another. The intelligent child observes much, seeing relations and significant differences between parts of an experiment or experience. He associates his observations with his past experiences and makes deductions and interpretations. All these mental factors are essential to his understanding.

Perceiving is a mental process involving the results of the activities of the sense organs. We are equipped with end organs, with intellectual capacity for perceiving, thinking, and feeling. This is a part of our native endowment and makes possible the assimilation of experiences. Our fund of facts is acquired from our experiences, but perception is an important and essential step in their acquisition.

Experiences are important in perceptual learning. As has been stated before, it is through the action of the sensory end organs that all experiences are changed into some form of mental content. It is through these that we build our world — our mental world, a world of knowledge, of imagination, and of cognition and reasoning. Whenever there is an error or a limit in the experience, there is an error in interpretation and meaning. Too little attention is often given to enriching the sensory experiences of children. It is a well-known fact that a complete understanding requires the stimulation of more than one sensory end organ: it requires many experiences and the recall of other and similar experiences.

A fact in geography is not fully acquired without the ability to interpret the printed page, to understand the

statement of facts about a place, to see the map, to draw the map, and to take part in the discussion. The eyes, hands, and ears form a great combination for the acquisition of facts. This type of teaching requires careful planning and thinking on the part of the teacher. Children's percepts as a rule are inaccurate, incomplete, and only vaguely interpreted. They need guidance, and this is the work of the teacher.

The concept of time and space is a matter of perceiving. Correct perception is a matter of trial-and-error, of the elimination of nonessential and irrelevant factors. Reading illustrates perceptual learning. The learner must receive sensory stimulation and must be able to give the words and sentences some meaning and to see the relation of one word to another. There must be the proper synthesis and interpretation of sensations. The form and proper relation of words must be perceived in order to get the proper meaning.

QUESTIONS

1. How does a perception take place?
2. Has a pupil the experience necessary to give exact meaning to a new perception?
3. What does a sense organ have to do with perception?
4. Why is the laboratory method so valuable in learning a lesson?
5. Does every perception have a feeling-tone? Explain.
6. List the factors essential to a clear perception.
7. Is perception a learning equipment? Explain.
8. How can we control our perception?
9. Explain how reading illustrates perceptual learning.
10. What would life be without perception?

REFERENCES

- CRANE, G. W. *Psychology Applied*. Northwestern University Press, Chicago, 1932.
- DOCKERAY, F. C. *General Psychology*. Prentice-Hall, Inc., New York, 1932.
- GIFFORD, W. J., and SHORTS, C. P. *Problems in Educational Psychology*, Chap. X. Doubleday, Doran & Company, Garden City, 1931.
- JAMES, WILLIAM. *Principles of Psychology*, Vol. II, pp. 134-282. Henry Holt and Company, New York, 1904.
- PYLE, W. H. *The Psychology of Learning* (Revised Edition). Warwick and York, Baltimore, 1928.
- THORNDIKE, E. L. *Educational Psychology*, Vol. II. Teachers College, Columbia University, 1913.
- THORNDIKE, E. L. *Human Learning*. The Century Co., New York, 1931.
- WHEELER, R. H., and PERKINS, F. H. *Principles of Mental Development*, Chap. VIII. Thomas Y. Crowell Company, New York, 1932.

CHAPTER XII

ASSOCIATIVE LEARNING

We have studied learning from the biological and physiological points of view. We have seen how sensations become percepts, images, memories, and ideas. We have learned that there must be a relationship between ideas, images, and experiences in order to learn easily, readily, and effectively. Associative learning grows definitely and directly out of perceptual experiences and perceptual learning, which requires memorizing. Recall would be impossible without association. Imagery requires association. The whole memory process would be impossible without association. The physical basis of association is the nerve fibers; the intellectual basis is the relationship between ideas.

ASSOCIATION AND ITS RELATION TO LEARNING

Association is the process of relating two or more experiences to each other. It is necessary to all learning. A sensation gains in meaning through being related to some other experience. Association may not result in memory, but memory cannot exist without association. The same holds true of imagination and reasoning.

The physical correlate for the associative process is the connective mechanism of the nervous system. This exists in all stages of complexity from comparatively direct pathways through simple neural arcs to exceedingly intricate combinations in the association area of the cortex and subcortical association fibers. The associations already

established in reflexes at birth may be interrelated in innumerable patterns.

It is a well-known fact that when a mental experience has been connected or associated with another mental experience, the resulting tendency is for the one that was experienced first to arouse the other. This process is constantly going on in class recitation. The teacher asks a question; the recall or answer is a matter of association. The study period is the time for the formation of associations, and the recitation is the time for strengthening them through pleasant recall and discussion.

Content and meaning are given to all our experiences through the psychological process of association. Mental development and growth depend upon the effective formation of associations or connections.

METHOD OF MAKING ASSOCIATIONS

The process of making connections is always going on, but these connections are by no means made at random. There is a good reason for every association that is made. There need be no awareness of the reason for the association or even of the fact that it is being made. There is, however, an awareness in the deliberate making of some associations, such as those involved in reasoning.

Association has been called the law of habit in the cortex, and in this sense it is one phase of the general topic of habit formation. Through this process the conditioned reflex is made possible. The process of relating two experiences conditions the individual to some degree, but this conditioning is often so slight as to give no evidence in behavior. Comparatively few of the countless associations made daily are destined to become habitual. This is exceedingly fortunate for us. It permits us to forget many of the errors we make

and helps us to eliminate useless acts. Forgetting those experiences which are of little value increases the possibility of acquiring skill in useful acts.

The basic principle underlying the formation of associations is the law of contiguity. When brain processes are active in close succession, they tend to become related. A corollary of this may be stated to explain how complications come about. Two mental processes which have been related to a third process tend to be related to each other. A teacher has in her class a pupil named John who always obtains a grade of 100 in arithmetic. She comes to associate these two—John with 100 and 100 with John. Another pupil begins to attain the same high grades, and the teacher makes a new association—James with 100. She finds that the thought of one of these pupils calls to mind the other pupil, although the two have never before been related in any way.

CONDITIONS OF ASSOCIATION

Associations are made under definite conditions. The directing of the learner in the making and fixing of associations is an important function of teaching. Many mental processes are constantly going on in the child. These offer almost infinite possibilities of relationship. Some of these relations may be meaningless and a hindrance to educational development. The problem of education is that of stimulating and guiding the pupil so that he will be able to make useful and effective associations. An important step in doing this is found in the control of the pupil's experiences. This control is effective to the degree that it recognizes the fundamental principles of association.

The law of contiguity states that those experiences which are closely related in space or time tend to become associated. In view of the fact that one experience is related

to all the other experiences which make up its setting, the control should be operative in the entire situation. In any learning situation, the scenes should be set and the characters and forces determined as in a drama. There is a common failure to recognize the complexity in the setting and to provide adequately for it. Each individual case is unique in its requirements. A teacher may feel that she has performed her task fully when she has placed before each child in the room a mixed multiplication table for study. An analysis of the situation shows that there are many other factors involved. The presence of distractions in the range of vision or hearing and the complexity of the series are typical objective factors. There are also many subjective experiences which are effective in modifying the associations even more seriously. The accumulated habits of the child, his memories, his feelings, his general emotional tone, his lines of imagination, are very significant. Some consistent attempt must be made so to regulate all these that they may be conducive to the making of the associations desired. For best results the elements in the setting must be in harmony with the end in view.

Such a control will lead to the isolation of certain experiences for special attention. This should take place according to what may be called the principle of emphasis. Two experiences are successfully associated when they are adequately emphasized. In some cases this emphasis is secured spontaneously by the nature of the experiences themselves; in others the teacher must endeavor to bring about the required emphasis through deliberate controls. Spontaneous associations are often extremely wasteful. The play of the mind, such as daydreaming, leads to no definite end, although it is very fruitful in association of images or ideas.

Relations of cause and effect come readily into association. These are usually appreciated more fully by older

persons than by young ones because of the need for a process of generalization from many experiences. They involve an awareness not merely of some orderly succession in time but also of an essential order or succession. In the teaching of handwriting, a child is shown the proper position and also the proper slant to use. As time goes on, he fails to learn the slant desired. He is also in error in his position and must be constantly corrected. If at this crisis the teacher can succeed in showing the child the causal relationship between the two, an association will have been made that otherwise would not be formed. When the child knows that wrong position is followed by wrong slant, and that correct slant is easily attained when the position is correct, his confusion gives way to a definite aim.

The comparison of experiences, involving the recognition of points of similarity and contrast, affords emphases that determine associations. One may bestow on a stranger the effects of an accumulated hatred for no other reason than that he resembles in facial expression some other individual who is known to have performed an act of injustice. One of the verbal associations that is early acquired is that of opposites, in which there is a definite contrast, such as "night" and "day," "good" and "bad," "tall" and "short," "hot" and "cold."

The association which will be made is determined largely by the mental set of the learner. The readiness to make certain associations is in itself an emphasis. Interest is the active evidence of such a readiness. The child who brings to the situation a favorable emotional tone will make associations more readily. Repeated failures in a subject may result in such a dislike for it that associations are made with great difficulty, and this in turn leads to more serious failures.

The entire physical organism of the learner is of basic significance in fixing associations. The conditions of asso-

ciations noted up to this point have assumed an average, normal person as learner. It is evident, however, that any defect of the accessory apparatus, the end organ, the nerve fiber, the nerve center, or the reacting mechanism, tends to interfere with, or may even block, the formation of associations which depend upon the use of these neural tracts. It would be hopeless to attempt to teach the child to say "cat" when he sees a cat if all possible association pathways between visual and auditory or speech centers had been destroyed. Illness, fatigue, lack of sleep, improper functioning of glands, and other conditions which weaken the body interfere with the formation and retention of associations.

DEFECTS OF ASSOCIATIONS

Association centers or fibers may be nonfunctioning from birth or be broken by disease or injury. In such cases it is impossible for an individual to form certain connections. There are children in school who have some difficulties of this type. One of the common defects is known as apraxia, or inability to make a certain desired movement or combination of movements. It is not identical with paralysis, for the power of random movement is not destroyed. The individual is unable to make associations between certain ideas and the motor responses. If a true breakage exists in the association paths, continued instruction will result in no improvement unless substitute connections can be established.

There are various types of aphasia, or loss of ability to speak. The person is not mute, for he can make vocal sounds. In motor aphasia there is a lack of connection between the speech center and the motor areas of the cortex, so that although he may think of the way a word sounds, he cannot pronounce it. In auditory aphasia, no

association is possible because he is unable to image the sound of the word. The impression is made, but the sound of one word may not be distinguished from that of another. Another type of aphasia makes the appreciation of meanings of words or ideas impossible. A special type of aphasia is called alexia, or inability to fix an association between a word and the reading of the word. A similar difficulty in the case of writing is called agraphia.

There are varying degrees of these defects, sometimes involving comparatively few connections, and at other times a large number. Because a child gives evidence of difficulty in forming some of these associations, it must not be hastily inferred that he is suffering from an irremediable defect. It is more probable that the difficulty arises because of inhibitions or interference of habits. Only in case of prolonged difficulty, with no progress after all the resources of the teaching art are exhausted, need a central defect be assumed.

THE TESTING OF ASSOCIATIONS

The only way in which the existence of associations can be proved is by some method of recall, as in remembering, in the display of skill, or in the use of the particular associations in a complex mental reaction, such as imagination or reasoning.

Any school test is a means of determining the degree to which associations have been made and to what extent they have persisted. Free association tests are of two kinds: in the one the individual recites as many different words as possible within a certain length of time; in the other he is asked to respond to a spoken stimulus word with another word that is suggested by it. One of the leading tests of this nature is the Kent-Rosanoff Association Test. It is found that certain words are most common among the

responses made by a large number of persons and that others are given but rarely. The test is used as a means of discovering how many unusual responses the subject may make. The results are taken as an index of originality.

Controlled association tests differ from free association tests in that the subject is forced to limit his response according to certain conditions. He is told to give the opposite of each stimulus word, to give a part of which the word is the whole, or the reverse, or to give the genus of which the word names a species. This type of test is used to good advantage in vocabulary tests, in measuring range of information, and in discovering knowledge of relationships.

Standard examinations are composed of many different types of tests which give indications of richness of associations. One marked difference between the bright and the dull child has been found at this point. If both were to live in approximately the same environment from the time of birth, the former would not merely perceive more than the latter but would establish a far more varied and complex set of associations.

EDUCATIONAL CONSIDERATIONS

The school should provide a suggestive environment of such a character as to assist in the process of fixing associations. It is difficult to associate ideals of studiousness, good order, coöperation, and optimistic good fellowship with the situations of life unless the schoolroom itself gives evidence of these qualities.

The richer such associations are, the more fruitful will be the outcomes. Associations, to be productive, should be directed by a definite purpose.

The ease and the readiness with which associations are formed depend upon the knowledge of their meaning. Mere

rote associations are uninteresting and are soon lost in the maze of competing interests. All new connections should be formed in terms of the individual's experiences. Care should be taken that the associations desired are adjusted to the age and the particular interests of the individual. That which has significant meaning to a child of ten may have no significance to the youth of sixteen. Verbal associations, as in the learning of a foreign language, are often more readily made in early childhood than in adult years.

Objects and ideas should be presented through several different senses, when possible, and should be carefully associated in all their relationships. Associative activity is a synthetic process by means of which the various sensational experiences are unified. A child sees a snowball for the first time. Through his vision he sees that it is white. Through touch he finds that it is smooth and fairly hard. His temperature sense records an intense cold. It is tasteless and without odor. His muscle sense shows it to be heavy compared with cotton. Through the compounding of various sensations he gains a percept of roundness and an estimate of size. Holding it for some time, he experiences a painful ache. When these experiences are all associated, the child now has a fairly adequate idea of a snowball. If any one of the experiences were omitted or the association were not made, the idea would to that extent be deficient.

Associations are not an end in themselves. They lead to the formation of systems of thought and to the solution of problems. The mere fixing of certain relationships in mind so that they may be recalled through memory cannot be compared with the complex organization of associations which is characteristic of the thinking man.

Associations are made and fixed only in the way in which they are given. When a connection has been made in a

certain order of arrangement, it cannot be assumed that the learner has also a direct control of the reverse order. Common illustrations are found in the difficulty in saying the alphabet backwards, in translating English into Latin, and in reading shorthand.

Uncritical associations may lead to erroneous knowledge or belief. Because one experience follows another, the child may infer a causal relationship which does not exist. When two objects are similar in certain aspects, he may make the hasty generalization that they are altogether alike. His mental set may lead him to read into a situation characteristics which are not present. Many illusions are attributable to the tendency of the observer to make only partial or incorrect associations.

Closely related to this is the tendency to mix the associations in surprising and unexpected ways. Such was the case in the classic anecdote when the child read, "This is a warm doughnut; step on it" from the words of his text, "This is a worm; do not step on it." It is impossible to anticipate all the experiences of a child and to provide for them. An apparently insignificant factor in the environment may exercise great weight in his experience. He may give close attention to a certain aspect which the teacher considers of no value, with the result that a wrong association is made and that the association the teacher desired him to make does not function. The child who associates good handwriting with the penmanship drill period but not with the written composition lesson is making a natural mistake.

The formation of associations is a basic step in the process of learning. The acquisition of a vocabulary and of skill in the use of the so-called fundamental operations of arithmetic is dependent upon associations. Memories depend upon the formation of adequate associations. They furnish

the framework for intellectual life. The great task of education is to provide this framework, for upon this rest all the higher processes.

ORDERLY ASSOCIATIONS ESSENTIAL TO LEARNING

The chief aim of education is to develop correct habits of association; to establish connections between bodies of knowledge so that these may be used in orderly thinking. Often children do not learn because of an interference either in the neural process or in the association of ideas. Illness, drugs, or injury may cause an interference in the neurones, while a confusion of thought or an overstimulation of emotions may interfere with thinking and learning. Hardly a day passes but this is experienced to some degree by all. Divided attention is an illustration of such interference. When there is a state of divided attention, there is usually an intense feeling which may be the cause of the interference. These strong feelings may result in obsessions, which if continued may become a permanent state of mind. Fear is probably the strongest emotion we experience that interferes with the normal learning process.

The state of so-called "inattention" is a matter of disorderly association. While it is recognized that there is no such state as inattention in an active being, orderly association demands attention along a definite line of thinking or acting. These orderly associations are the productive inhibitions. To be able to keep nonessential ideas from occupying the center of the field of attention is a scholarly art. Every association of ideas is more or less imperative. The habit of wandering from the essential to the nonessential is very common and very harmful to the learner. If this process is continued, it will result in inaccuracy in learning. Whenever we associate the wrong pronunciation with a

word or associate the wrong facts in history or geography, the wrong association is almost sure to be remembered and to cause some degree of confusion.

The poor learner is seldom straightforward in his thinking. He cannot hold to one thought. Free association plays a very active part in his mental life. There is always some interference in association; but the good learner is able to inhibit the associations that are not pertinent to the problem under solution. In highly trained and intelligent individuals, interference in the associative process is the exception. The development of habits of attention and orderly associations are important factors in the acquisition of knowledge and the prevention of mental conflicts.

ASSOCIATION A FACTOR IN MEMORY

Psychology teaches us that memory is an image of a past experience with the awareness that it is a past experience. The mere recall of a past experience does not constitute memory; it is only one phase of it. There must be added to this the feeling of familiarity or of recognition. This process of recall is possible because of association. There is no learning without memory, and memories are inter-related by connections which have some common element. This means that there must be something in common between what is in the immediate center of the field of consciousness and the past experience. The tendency to recall past experiences is a physiological quality of the brain tissue. The modifiability of the synapses is essential in the formation of associations as well as in retention. Good memories depend upon well-organized systems of associations. These are necessary to all learning.

The improvement of the recall of the learned material or past experiences is accomplished by forming more or

better associations. Failure to recall a fact may be, and usually is, owing to a failure to make the proper connections between the present demand and the past experience. The idea to be remembered must be attached to definite associations. It is not sufficient merely to repeat a number until it can be retained. The number must be associated with some experience or fact that is easily stimulated and recalled. These are spoken of as cues. It is of little value for a pupil to repeat "231 cubic inches" without establishing associations and connecting the phrase with a definite idea or fact. This fact must be associated with experiences of knowledge so that they will come to mind in connection with the number of cubic inches in a gallon.

Everyone has isolated or unattached ideas, such as dates, names, and chemical formulas. These are useless because they have not been organized into systems or attached to already acquired knowledge. The reason a boy remembers baseball scores and not dates in history is that he has formed his baseball scores into a well-organized system or order. Recall is always a matter of association. How good the recall is depends upon how efficient the associated connections are.

There are three forms of associations used in memory. The first of these consists of the artificial connections which give rise to what is called mechanical memory, as when one memorizes the words of a Latin poem without understanding it, or the rule for finding the area of a circle, or the lists of presidents of the United States. Spelling is largely a matter of mechanical associations. These are used in rote memory.

The second form of association used in recall may be owing to ingenious connections between the image and the cue. The colors of the spectrum may be recalled by the word "vibgyor," or the spaces in the treble clef by the word "face." This may be an effective method of remembering

meaningless facts, but it should not be used in remembering facts that are of value because of their meaning.

The third form of association is used in logical recall and gives rise to logical memory. This is made possible through understanding the significance of each topic and its place in some system of thought. A historian remembers the names and dates in history because each has its place in his systematic thinking, but he may have difficulty in remembering a dinner engagement or a shopping list. The boy whose memory for historical facts is notoriously unreliable may be a recognized authority on sports records. If he would organize his history as he has organized the sport scores, his standing in class would show a gratifying change.

THE PROCESSES INVOLVED IN MEMORY

Every act of memory involves four basic processes. These processes must function in every act of memory if it is to be effective. The first process has to do with the receiving of experiences. It involves the impression made on nerve tissue.

The second process involved in memory is the retention of this impression. There must be a formation of a nerve pattern which will function in recall. The retention of the impression depends upon the plasticity of the neurone and on the modifiability of the synapses. In every impression there is an exercise of the neurones that make up the nerve patterns. There is a change in the arrangement of the elements of the nerve fibers exercised, and these elements may never return to their original arrangement. This constitutes retention in the nerve tissue. The variations in the modifiability of the synapses determine individual differences in memory.

After the stimulus which makes the experience possible

has been received and a change which makes retention possible has taken place in the neurone, then the third process takes place, the recall of the image through association. It has been stated before that there are no isolated experiences. All recall is through association. The most important factor in recording experiences is that of association. Association is the relation that exists between experiences. These associations have a physical basis. Thus we have both physical and mental associations. The richer and more immediate the associations, the clearer the recall. Confusion in the recall of ideas results from a multiplicity of associations that are not properly organized.

The fourth process in memory involves the recognition of the image as a past experience.

These four processes are essential to memory. If one of them fails, there is a failure of memory. A pupil may excuse his ignorance by stating that he has "forgotten" the lesson. His inability to remember may come from failure to receive the impressions, or it may be that his attempt to secure an adequate impression was only half-hearted because of lack of interest, shortness of time, or distractions such as baseball, motion pictures, or outside work.

In other cases there may be a failure to remember, although the impression itself was entirely adequate. Here the failure may arise from poor retention. Many failures to remember can be traced to difficulties in recall either because insufficient associations have been made or because the "cue" has been lost. In still other cases failure to remember may be owing to the inability to recognize. Here the image is received, retained, and recalled but is not associated with any former knowledge or experience. It is possible actually to recall the correct spelling of a word and yet not realize it. The connection between the spelling and a recognition that it is correct is missing.

IMPROVEMENT IN FORMING ASSOCIATIONS

Improvement in forming associations is accomplished by repeating the association until it is firmly fixed or until a habit has been formed, by substituting logical for mechanical and ingenious associations, and by changing isolated types of associations into logical systems.

Early associations in any series are the most reliable. This is why the first elements of any series can be easily recalled. The last elements are also relatively easy to bring into the focus of consciousness, whereas the middle ones are the most difficult to recall. Almost anyone who has studied history can name the early presidents and the more recent ones but will experience difficulty in recalling some names in the middle of the series. Everyone can sing the words of the first and last stanzas of the national anthem, but very few can recall the words of the middle stanzas.

Recognition requires a rich setting of meaning or a feeling of familiarity. This may vary from a vague feeling that we have had the experience sometime, somewhere, to a very definite recognition and placement in time and space, giving complete confidence in the accuracy of the image. A clear understanding and interpretation of all related facts will aid in the proper association and recognition of new experiences.

FORGETTING

The fact that it is so easy to forget and so difficult to remember is often of great advantage. Successful thinking in school as well as out of school is dependent on the ability to remember essential facts and the ability to forget the nonessential. This is the secret of clear and efficient thinking. Many have an extraordinary capacity to remember details, however nonessential: they will remember the day of the week and the day of the month of trivial events, what

was said, and the exact words of an explanation, but they may not understand the underlying principles or the importance of the events remembered.

Forgetting comes from a lack of proper associations, from a lack of plasticity in the nerve tissues, or from both. There is a tendency to forget facts which do not seem significant or important as well as facts to which a personal interest is not attached.

THE MEMORY OF CHILDREN AND ADULTS

It is commonly believed that children can memorize better than adults, but scientific experimentation has produced evidence to the contrary. In immediate recall children fall far below adults. There is evidence of improvement in memory from infancy to maturity, after which it remains nearly constant until old age. This holds true for immediate recall.

In regard to the permanence of memory, there is evidence that facts learned in childhood remain longer than those learned after maturity. In old age it is the facts acquired and the experiences enjoyed in youth that persist.

Children's memories are different from those of adults. In mechanical memory adults acquire associations better than do children, but children retain these mechanical associations better. Associations involving ideas and thought processes are remembered better by the adult. The memory span of an adult is greater than that of a child. Primary children can remember simple short selections, and the pupil in the grammar grade is able to memorize short poems. In the high school long and difficult selections of literature can be memorized. Primary children can make but few associations because of their limited experiences and ability to attend. It is in these respects that high-school pupils are superior in memory.

MEMORIZING IS THE FORMING OF ASSOCIATIONS

How can information be memorized most economically? The answer to this question is the key to efficient learning. Memory may be made a labor-saving device. A topic once mastered may be recalled in its complete form, provided it has been sufficiently overlearned to need no relearning. It is essential to have a capacity to memorize in order to save relearning; otherwise each topic would have to be relearned each time. For this reason a pupil whose memory is not reliable makes slow progress during the early years of school. On the other hand, a pupil whose memory is so effective that he can rely largely on what he has been told, and can thus avoid the fatigue and effort of independent thought, is a star performer on review work. He makes rapid progress in the early years of school, but later he may find himself compelled to follow others rather than to be a leader or an independent thinker. Memory is a good slave but a poor master. Mechanical memory is invaluable during the first stages of the learning process, but it becomes exceedingly undesirable in subjects where judgment and reasoning are involved and where logical memory is required. Whenever it is especially desirable that facts be remembered, we can accomplish this end by extending the usual procedure of memorizing to the point of mastery. Learning is usually spoken of as the ability to be able to reproduce without error what has been committed to memory. This immediate requirement is not sufficient for permanent recall. Much school work must be overlearned, that it may be retained for use in later life.

Cramming consists in mechanically memorizing what should be understood and mastered in a systematic way. Students often postpone logical, systematic study until shortly before examination and then rely on intensive me-

chanical memorizing to carry them through the test. Usually the result is distressing. Intensive review before an examination is beneficial; but if the facts have not been mastered during the course, any attempt to fix them in memory may be ineffective. There is no royal road to learning.

Experiments in learning show that it is usually more economical to learn the selection as a whole than to learn it bit by bit. This, of course, is true only if the whole selection can be taken as a unit which is not longer than can be learned in a reasonable period of time.

To memorize economically it is necessary to perform the act, exercise it, and have the exercise accompanied by a feeling of satisfaction. Thorndike has put the laws of economical learning together in the following form :

Put together what should go together, and keep apart what should not go together. Reward desirable connections, and make undesirable connections produce discomfort. . . . Exercise and reward desirable connections; prevent or punish undesirable connections.¹

The essential problem involved here is to be able to select what facts should go together and what should not. This involves the selection of the essential and the omission of the nonessential. There are other factors involved in economical learning. Learning is most effective when one is physically fit and not suffering from fatigue. Interest is an essential factor in the making of impressions. All impressions and connections should be learned correctly at first; accuracy is a great saver of time and effort. Recency of repetitions is essential; for if too much time elapses between the first stimulus and the second, it will be necessary to increase the intensity of the stimulus. Old connections and old associations should be utilized wherever possible.

¹ E. L. Thorndike, *Educational Psychology (Briefer Course)*, p. 142.

Another factor in economical learning which must not be overlooked is the emotional tone of the individual at the time of learning. Not only does the individual recall facts connected by logical or mechanical associations, but he also tends to recall facts which have the same emotional tone. When we are happy, we tend to recall happy experiences; when we are sad, we tend to recall other sad occasions. The angry person does not think of pleasant experiences but of other angry moments. It is an error to require pupils to memorize poetry as a punishment for wrongdoing. The images have a wrong emotional setting, which may lead to a distaste for the subject in later years. The mental distress and apprehension aroused by a severe examination is not conducive to the recall of facts acquired in the course under happier conditions. These facts may interfere with the economy of learning. The emotion of an individual should be taken into consideration in teaching and learning. Many a fine student who was wonderfully well prepared may be emotionally disturbed at the time of the test and be utterly unable to recall the answers to the questions asked, but shortly after the test period is over he may recall the answers to every question. Learning is most effective when the learner and the teacher are both happy in their work.

SUGGESTIONS FOR TEACHERS

Childhood is the great learning period of life. Many associations should be formed and fixed at this time. Later in life this can be done only at an enormous expenditure of time and labor. Useless material should never be assigned to pupils as a memory exercise. Memory gems with little or no meaning for the pupils, and maxims which have not grown out of the pupils' own experiences, are hardly worth committing to memory.

Rote and immediate memory should be exercised during the early years of child life. The habit of memorizing is exceedingly valuable. It may be of service in later years.

The development of logical memory is one of the ways of developing children's thinking. Logical memory is essential to all thinking. It has been found that the one who remembers best can usually reason best. The pupil who has mastered his multiplication combinations is usually able to solve problems better because he does not have to devote either time or energy to these simple calculations.

A large fund of information at one's command is a great aid in the formation of judgments. It has been found that there is a very high positive correlation between logical memory and intelligence. Students who stand high in their daily class work pass the best examinations and retain the most facts. The pupil who recognizes significant facts as such and can recall and use them is intelligent.

Association forming is essential to all memory, and memory is necessary in all learning. It is indispensable in constructive imagination, and it is necessary for all thinking. Mere memory is not sufficient for complete living or for full development, but it is essential in the acquiring of skills, knowledges, and information to meet life situations. Drill and overlearning must take place in every school subject and in the acquisition of every important fact in life. Memory work is essential for the proper development of the individual.

QUESTIONS

1. How are associations formed?
2. How may the project method be used to illustrate conditions of association?
3. How do you explain errors in spelling?
4. What is the physical correlate of association?

5. List the conditions of association.
6. Why do some people have trouble in reading, in speaking, in thinking?
7. How would you test the associative process in the subject of arithmetic?
8. What is a free association test?
9. Explain how association is a factor in memory.
10. How can association be a factor in forgetting?
11. In memorizing a poem what associations are used?
12. How may teachers help students in the formation of correct associations?

REFERENCES

- BOOK, W. F. *Economy and Technique of Learning*, Chap. XXIV. D. C. Heath & Co., New York, 1932.
- FREEMAN, F. M. *How Children Learn*, Chap. X. Houghton Mifflin Company, Boston, 1917.
- GIFFORD, W. J., and SHORTS, C. P. *Problems in Educational Psychology*, Chaps. XI, XII, XIII. Doubleday, Doran & Company, Garden City, 1931.
- MUNROE, W. S., DE VOSS, J. C., and REAGAN, G. W. *Educational Psychology*, Chap. V. Doubleday, Doran & Company, Garden City, 1930.
- SKINNER, C. E., GAST, I. M., and SKINNER, H. C. *Readings in Educational Psychology*, Chaps. XIII-XX. D. Appleton and Company, New York, 1926.
- THORNDIKE, E. L. *Educational Psychology*, Vol. II, Chap. III. Teachers College, Columbia University, 1913.
- THORNDIKE, E. L. *Human Learning*. The Century Co., New York, 1931.
- TROW, W. C., *Educational Psychology*, Chap. VIII. Houghton Mifflin Company, Boston, 1931.

CHAPTER XIII

THINKING AND LEARNING

The ultimate aim of education is to develop the ability to think clearly, logically, and constructively for the solution of definite problems, to marshal and organize past experiences, and to work in the search for truth with an open mind, without prejudice, to the end that man may adjust himself to his environment and to his fellow men. Constructive thinking is the most effective means of reaching this goal.

WHAT CONSTITUTES THINKING

The complex mental processes as well as the simple ones involve certain physiological conditions. The simplest form of mental life — sensations — is the result of outside or inside forces acting on sensory structures. The more complex associational processes involve numerous complex connections in the cerebrum. The simpler mental processes require little time, whereas the higher and more involved processes often require a great deal of time and delay, owing to the reorganization of extremely complex associations or patterns. This can also be noticed in the delay in such relatively simple central processes as discrimination of a particular sound. The more abstract ideational processes as well as the simpler ones are accompanied by feelings. These, in turn, determine in a large measure the degree of attention and manifest themselves in facial expression and other forms of bodily movement. Belief, a form of the higher thought processes, is both idea and feeling in close

relation to behavior. Belief exists when certain experiences are organized in harmony with one another and are accepted as the basis of the individual's attitudes and conduct.

Thinking comes as a result of experiences or through organization of experiences. The practical uses of experience precede the beginning of connected thinking. The causes of events are sought in individual cases. Uncritical speculation soon follows. Primitive history abounds in cases where the forces of nature were personified. From this personification superstitions arose and multiplied. Signs, omens, witchcraft, magic, and medicine men flourished. Out of this unorganized material, science has organized its systems of thoughts of relationships. Early Greek philosophy tried to find some cause for all things, some unity in the world. This attempt resulted in a mixture of keen insight and popular superstition. The critical attitude has always contained a good deal of skepticism. Doubt and skepticism do not necessarily indicate a thinker, but a thinker must always doubt or question accepted belief.

There would be no thinking without ideas. However, merely having experiences or ideas is not thinking. There must be a realization of relationship between ideas or experiences. This consciousness of relationship is thinking. Thinking always involves a problem and an effort to solve it. Any kind of problem will answer the purpose as a stimulus. It is essential in bringing about a response that the person use his experiences for the purpose of discovering a solution. The important condition is to have problems which fall within the range of his experiences and which appear to him to require a solution. Highly formalized teaching frequently fails in this respect, with the result that the real thinking of the pupil is done outside the schoolroom. A boy may fail in formal arithmetic in the classroom, whereas he will succeed on the playground or

at a Boy Scout meeting when faced with a real problem involving the same mathematical principles and formulas.

Idle observations, recollections, daydreams, undirected and uncontrolled associations, do not involve thinking. A boy who idly watches a snail crawling over a stone or who fastens his eye on the wall map may not be thinking at all. If, however, he watches the snail for the purpose of discovering its mode of locomotion or its speed under varying conditions, then he is thinking about the snail. If he is looking at the map for the purpose of discovering the best route to take on a hike or an automobile trip, he is thinking about the map in relation to his problem. Images of past experiences may parade through his mind: this is reverie, not thinking. Thinking takes place when a pupil organizes his past or present experiences for the purpose of establishing relationships which lead to the solution of a problem; for example, "Did I mail that letter?" "What topic did the teacher assign for special work in English?" "How do you divide fractions?" "Which president held office for the shortest time?" "What is wrong with my radio?" Under the impulse of the problem, he undertakes to discover facts or recall experiences that have a bearing on its solution. It is well for teachers to give children the experiences which are basic to thinking and also to furnish problems which the children can regard as real problems and in the solution of which they have a vital interest. Learning is not identical with mere memorizing. Learning involves understanding, that is, finding relationships between experiences and organizing them for use. A child may memorize something he does not understand; for example, a rule in arithmetic, a definition in grammar, or a Latin poem. He may also learn without memorizing in detail, as when he learns how to use logarithms, how to read a map, or how to adjust a radio.

THE LEVELS OF THINKING

There are three levels of thinking. Thinking on the lowest level employs concrete, or particular, ideas and experiences only. This is the simplest form of thinking. It predominates in children and in untrained adults. It is basic to the other forms of thinking. The second level of thought involves general ideas. It is sometimes spoken of as the level of abstract, or universal, thinking. The third level, the level of judgment and reason, is concerned with relational thinking. Each of these levels will now be considered in detail.

Thinking on the level of concrete, or particular, ideas involves perceptual thinking, memory, and imagination. Perceptual thinking is thinking about objects present to the senses. It depends on the use of such senses as sight, hearing, touch, taste, and odor. When a woman is engaged in matching cloth, she receives sensations of color from each of the pieces for the purpose of ascertaining which piece is most like the sample. Without this problem in mind, she would merely look at the different pieces of cloth and perhaps admire the colors or the patterns of each, but she would have no purpose. Many persons love flowers without studying them or thinking about them, but the student of botany must observe plants for the purpose of discovering relationships between them.

The process of perceptual thinking involves the following steps:

1. There is a situation with sense stimulation.
2. There is a problem.
3. There is recall of previous experiences which not only give meaning to the situation and problem but also point the way to the solution.
4. There is a response on the part of the learner in which

he tries out his solution. This response may be wholly one of trial and error or it may be an attempt to use a response which has been successful in other similar situations. A boy whose radio will not work will spend a strenuous Saturday afternoon on his problem because for him it is a real problem calling for his best mental efforts.

Laboratory work in school and many of the extracurricular activities present admirable situations calling for this type of thinking, which the formalized courses have largely neglected. Perceptual thinking is basic. It furnishes the concrete experiences out of which all other forms of thinking are derived. Therefore it is not too much to say that every subject studied from the kindergarten through the college and university must be founded on perceptual thinking, either directly, as in the case of laboratory courses and in courses involving field work, or indirectly, as in the case of courses in mathematics, literature, philosophy, or history. In all these courses, thinking must be based on those forms of thought which have been derived ultimately from sense experiences. This is the principle of induction, on which all modern science rests.

The second form of thinking on the level of the concrete centers on memories and thus involves the use of past experiences; for example, "What is the first sentence in the Declaration of Independence?" or "What is the capital of Czechoslovakia?" The process of thinking employed in all such problems is primarily a search for the reminder or cue. This in turn calls to mind a number of memory images, one of which may be recognized and selected as meeting the situation and furnishing a solution to the problems themselves. This mode of thinking is a favorite one with many teachers who confine their efforts to the words of the textbooks. Examination questions, from the lowest grade through the college and the graduate school, abound in

problems demanding this type of thinking for their solution, and many a student has received high rating in school because he has an accurate memory. Many of the best thinkers on the higher levels have found it difficult if not impossible to do satisfactory work in school or college purely on the memory level. They have achieved success in the sciences, in inventions, in the literary or the business world, through their ability to apply other modes of thinking to the solution of their problems.

Imagination is the third form of thinking on this lower level. In this form of thinking, the problem involves a new situation. Material from past experiences must be called into use. Whatever has a bearing on the situation is retained, and the rest is rejected. One whose mind clings too closely to the past finds great difficulty in thinking on this level, while the person who indulges in abstract critical judgment and reason is also not inclined to make use of imagination in solving his difficulties. On the other hand, the impractical idealist flies in the face of the established facts and resents the cool, critical judgment of the abstract thinker. Thinking on the concrete level involving the use of the imagination is required in the solution of many problems in mathematics. When the situation that has been set forth in the problem has been clearly imaged, the pupil finds relatively little difficulty in expressing it in the correct formula and reaching the solution. The important factor is to form a clear, definite image of the situation or problem.

The purpose of thinking on the level of abstract, or universal, ideas is to discover or to formulate ideas that are true of a group or class of experiences rather than of experiences on the level of sense perceptions. A child may learn through sense perception that the two halves of an apple make the whole apple, and he may remember or image many

other concrete examples where the two halves make a whole. As he turns his thought from the image of apples or sticks, he gradually arrives at the general notion that the two halves of anything constitute the whole. This brings him to the level of abstract thinking. He has now formulated a general principle that can be applied to the solution of any problem concerning halves. In the same way a pre-school child may learn how to use personal pronouns. He has learned this by imitation based on sense perception and memory and occasionally on imagination. Gradually he will note that the same facts apply to all the words of this group. He will begin to think of them as a class and to formulate principles of usage that apply to all of them alike. The purpose of all thinking on the level of universals is to discover the general laws that apply to the group and to disregard all the peculiar individual characteristics that apply only to single members of the group.

Either of two methods may be followed in forming concepts, or general notions. One of these, the inductive method of thinking, involves the discovery of the common elements of the group by a study of the individual members of the group. This is the method employed in all the sciences. The second method is that of deduction. In this form of thinking, the general notion is formed from a still more general notion by means of a definition. The process involved in induction consists, in the first place, in securing sense perceptions of a number of examples. These examples are compared, points of difference are ignored, attention is given to points of similarity, and finally the idea of the group is developed from these points of similarity. A child forms the general notion of islands first of all by securing sense perceptions of islands. He will recall islands of his experience and may also imagine other islands. From these he will form an idea of islands in general. The method of

deduction, on the other hand, requires that the child shall think first of all of land masses in general and add to this idea the peculiar feature of islands; namely, that they are totally surrounded by water. Many school subjects (arithmetic and grammar, for example) still make use of this method of thinking. This method may be and often is effectively used by trained adults. In the case of the immature mind, however, there is always the danger that the mere words of the definition will be memorized and substituted for the thought.

Many persons, adults as well as children, experience great difficulty in thinking in abstract terms. They are concrete-minded. When called upon to deal with classes of things rather than with individuals, they do not think of the universal qualities, or characteristics, of the class but use merely the word or the symbol that designates the class.

The third level of thinking is the relational level. The purpose of thinking on the relational level is to bring isolated experiences and seemingly unrelated ideas into systems of thought whereby we become more definitely aware of their relationship and meaning. The difference between ignorant persons and educated persons is not so much a difference in range of experience as it is a matter of organization and systematic thinking in regard to these experiences. A sailor may have a vastly wider range of experience than a scientist, but his knowledge is limited to the level of sense experience. The philosopher or the scientist, on the other hand, makes use of sense material for the purpose of formulating conceptual systems of philosophy or discovering laws and principles of science. Relational thinking may apply to percepts, as, "This pencil is longer than that one"; it may apply to memories, as, "Yesterday was colder than the day before"; or it may apply to imagination, as, "California is warmer than Idaho." Relational thinking

also exists between concepts, or general ideas, as, "The subject of a sentence is in the nominative case"; or the relationship may be between any combination of these forms of knowledge. A pupil's difficulty in solving problems in arithmetic may be caused by his inability to imagine the situation set forth in the problem, or he may fail to have the necessary mathematical conception, or he may have both of these and still not see a relationship between the problem and this concept.

Relational thinking is necessary in organizing concrete experiences into the sciences. The basic material in every science is obtained through sense perception. The concepts, or general principles, of science are gained through the process of conceptual thinking, but the systems of the sciences depend on relational thinking.

The unit of relational thought consists of two or more ideas, together with the consciousness of relationship between them. This unit is called a judgment. A judgment may be related to sense perceptions, as when a child passes judgment on the color, the size, or the shape of two blocks of wood; the judgment may be between an object of sense perception and a concept, as when a child judges that a given triangle is a right-angled triangle; finally, the judgment may be between concepts, as, "All circles contain 360 degrees." Judgments in regard to individual objects are called particular, or individual, judgments; judgments in regard to concepts are called universal judgments or principles. The latter are more difficult to form and require a much higher degree of mental capacity. In the affirmative judgment the relation is asserted, as, "This is a simple sentence"; in a negative judgment, the relation is denied, as, "'He' is not a relative pronoun." Judgment is the application of a concept to any situation, as, "Man is an animal." Two concepts are here brought into relation with

each other. There are degrees of definiteness both in concepts and in judgments. Often the concept is little more than the word naming it. Judgments are also dynamic. They may be either universal or particular. The predicates of affirmative judgments are not usually exhausted by the subject, whereas in negative judgments the whole predicate is included. In most judgments in common life the subject and the predicate represent two very different situations in the mind of the thinker. We consider the relations involved from the standpoint of the subject. A judgment is that mental process in which a concept is consciously related to another concept or to a particular experience.

Reasoning in syllogistic form consists of a combination of judgments. In its simplest form the syllogism is the comparison of two judgments, from which comparison a third judgment is derived. The two judgments so compared must have one term in common. This term serves as a common measure by which the other two terms are brought into definite relation.

Science undertakes to develop a coherent system of concepts and principles. Analysis and experimentation must be used in scientific work. The investigators seek to control the conditions, varying one factor at a time and observing the effects. Comparison of many instances in which a certain result appears may also lead to the discovery of the essential factors in the production of that result. Observation of cases is a great stimulus to thinking. Working with facts related to each other causes us to analyze, to regroup, to classify, to compare, and finally to see many points of connection not obvious to casual observers. Truth in science is by no means proportional to the mass of observations. Sometimes one case carefully studied will yield more definite results than the accumulation of thousands of cases will yield in another territory.

Logic gives us a statement of the forms, or laws, of thought; psychology tries to explain the nature and origin of these laws. Reasoning is merely an elaborate form of organization of experience. Thought is the consciousness of the relation between objects or between thoughts themselves. We think about these objects as related, not to us, but to each other.

HOW JUDGMENTS ARISE

Judgments may arise in one of two ways. They may arise through the analysis of a perceptual experience or of a general idea, making explicit a relationship which was previously implied. This is called an analytic judgment, as, "Snow is white," "This picture is interesting," "Lincoln was very tall." The purpose of the analytic judgment is to make clear and distinct what before was confused and vague. It does not increase the scope of one's knowledge, but brings out relations which previously had been neglected.

The second way in which judgments may arise is through synthesis of experiences that heretofore have been unrelated and now are brought into a relationship. Judgments of this type are called synthetic. Judgments formed in this way increase the range of knowledge, as, "Porto Rico is the same size as Connecticut," "The subject of a sentence is in the nominative case." Successful teachers understand the function of synthetic and analytic judgments and make use of each as the pupil's reaction may indicate.

The relationships which enter into judgments are as follows:

1. The formal relationships: difference, identity, and similarity ("This is the same problem we did yesterday").
2. The qualitative relations of genus and species (" $\frac{12}{5}$ is an improper fraction"); of substance and attribute ("This is wood-pulp paper").

3. Quantitative relations of time and space ("The Revolutionary War lasted eight years"; "Chicago is nine hundred and seventy miles west of New York").

4. Relations of cause and effect ("The Stamp Act was one of the causes of the Revolutionary War"; "The McKinley Bill resulted in the development of home industries").

5. Purpose ("Washington retreated to White Plains in order to preserve his army").

The very simplest form of relational thinking is found in the analytic judgment of differences between two perceptual experiences, as, "This color is different from that one," "This word is different from that word." The most difficult judgment to form is the synthetic judgment of purpose between concepts, as, "Economic pressure provides the strongest motive for industrial progress." As the child's mind develops he advances in his ability to form judgments that involve more and more difficult forms of relational thinking. Whenever he is required to make judgments that are beyond his intellectual capacity, or when he does not possess the necessary information, he will substitute mere words for the judgment itself. For example, when a pupil makes the statement "Washington was a great statesman" or "A high protective tariff resulted in the development of industrial monopolies," he may have formed a universal judgment or he may merely have memorized the words of a judgment. The pupil had formed his own independent judgment when he said, in answer to a question, "The book says that Shakespeare was the greatest poet in the English language, but I think that James Whitcomb Riley was."

The truth or accuracy of the judgments depends upon the establishment of the correct relationships. The certainty of a judgment depends upon the intensity of the relational element. This may vary from absolute certainty — "I know it as well as I know that I am standing here"

— to a mere guess, the assertion of a relationship we do not feel at all. There is no connection between the intensity or the certainty of a judgment and its accuracy. The guess may prove correct, and the absolute certainty may be false. It should be the constant endeavor of teachers to lead the pupils to form independent judgments, to test these judgments for accuracy and clearness, to refrain from "verbal" judgments, and to give adequate complete expression to judgments when they have been formed.

A second form of relational thinking deals with relationships between judgments leading to the formation of conclusions. We call this process reasoning or argumentation. The judgments which lead to a conclusion form the "grounds" for the conclusion, or, in logic, the "premises."

Forms of reasoning depend upon the type of relationship existing between the judgments. The earliest form of reasoning is by analogy: "Yesterday we solved a problem involving addition of fractions; today's problem is similar; therefore it should be solved by addition of fractions." This is the simplest form of reasoning. It is used in the elementary grades. Children are constantly looking back through textbooks in search of a problem similar to the one under consideration for the purpose of solving the new problem by the method that was successful before.

A second form of reasoning is by deduction. Deduction is based on the major premise, which is a general principle or rule, and a minor premise, which is a case to which this rule applies; for example, "All words ending in *ly* are adverbs; *quickly* ends in *ly*; therefore *quickly* is an adverb." If the major and minor premises are correct, the conclusion will be correct. This method of reasoning is used in arithmetic, geometry, grammar, and all other formal subjects.

A third form of reasoning is by induction. This method of reasoning consists in forming judgments about a number

of particular cases and deriving a general conclusion or rule from these cases by discovering the common qualities which they present. This type of reasoning is followed in the laboratory work of chemistry, physics, or biology. It may be employed to advantage in geography and history. It is the method which is employed in all topics using the case system.

Reasoning may be by disjunction. Here a situation is considered from every aspect. One after another of these aspects is eliminated until only one remains; this leads to the conclusions. This method is often followed by pupils who are unable to arrive at a conclusion by deduction, as, "There are three forms of sentences: simple, complex, and compound. The sentence under consideration is not a simple sentence, and it is not a compound sentence; therefore it must be a complex sentence"; or, "There are four fundamental operations in arithmetic: addition, subtraction, multiplication, and division. In solving a problem, addition has been tried without success, and so have subtraction and multiplication. This leads to the conclusion that division is the correct procedure." This measure of reasoning may be followed to advantage in advanced scientific research, but it is not advisable to use it in elementary school subjects.

Reasoning may be carried on by hypothesis. A proposition is set forth as a working hypothesis, conclusions are drawn on the basis of this, and these conclusions are tested by reference to established facts; for example, "If this test tube contains an acid, it will turn litmus paper red." We then dip the paper in the fluid and arrive at a conclusion as the paper does or does not change color. This method of reasoning is very common.

In developing relational thinking, the teacher and the thinker must both be on guard against the possibilities of error. These errors may be classified as errors of observa-

tion, of generalization, of deduction, or of disjunction. The pupil may be in error as to the arithmetical process involved in solving a problem because he did not read correctly the statement of the problem. He may apply the wrong principle or make errors in the operation.

REFLECTIVE THINKING

Reflective thinking, in the form of problem-solving, plays a large part in many school subjects. The success of the project method depends upon the use of this kind of thinking. The following is quoted from Dewey's "How We Think," as set forth in Parker's "Methods of Teaching in High Schools," pp. 183-184:

Origin in some perplexity. We may recapitulate by saying that the origin of thinking is some perplexity, confusion, or doubt. Thinking is not a case of spontaneous combustion; it does not occur just on "general principles." There is something specific which occasions and evokes it. General appeals to a child (or to a grown-up) to think, irrespective of the existence in his own experience of some difficulty that troubles him and disturbs his equilibrium, are as futile as advice to lift himself by his boot-straps.

Form a tentative plan based on past experience. Given a difficulty, the next step is suggestion of some way out — the formation of some tentative plan or project, the entertaining of some theory which will account for the peculiarities in question, the consideration of some solution for the problem. The data at hand cannot supply the solution; they can only suggest it. What, then, are the sources of the suggestion? Clearly past experience and prior knowledge. If the person has had some acquaintance with similar situations, if he has dealt with material of the same sort before, suggestions more or less apt or helpful are likely to arise. But unless there has been experience in some degree analogous, which may now be represented in imagination, confusion remains mere confusion. There is nothing upon which to draw in order to clarify it. Even when a child

(or a grown-up) has a problem, to urge him to think when he has had no prior experiences involving some of the same conditions is wholly futile.

Plan not accepted until carefully examined and criticized. If the suggestion that occurs is at once accepted, we have uncritical thinking, the minimum of reflection. To turn the thing over in mind, to reflect, means to hunt for additional evidence, for new data, that will develop the suggestion and will either, as we say, bear it out or else make obvious its absurdity and irrelevance. Given a genuine difficulty and a reasonable amount of analogous experience to draw upon, the difference, *par excellence*, between good and bad thinking is found at this point. The easiest way is to accept any suggestion that seems plausible and thereby bring to an end the condition of mental uneasiness. Reflective thinking is always more or less troublesome, because it involves overcoming the inertia that inclines one to accept suggestions at their face value; it involves willingness to endure a condition of mental unrest. . . . Reflective thinking, in short, means judgment suspended during inquiry, and suspense is likely to be somewhat painful. . . . The most important factor in the training of good mental habits consists in acquiring the attitude of suspended conclusion and in mastering the various methods of searching for new materials to corroborate or to refute the first suggestions that occur. To maintain the state of doubt and to carry on systematic and protracted inquiry — these are the essentials of thinking.

Parker, in his "Methods of Teaching in High Schools," summarizes as follows :

To stimulate and assist pupils in carrying on reflective thinking the teacher should

- I. Get them to *define* the problem at issue and keep it clearly in mind.
- II. Get them to *recall* as many related ideas as possible by encouraging them
 1. To analyze the situation, and
 2. To formulate definite hypotheses and to recall general rules or principles that may apply.

- III. Get them to *evaluate* carefully each suggestion by encouraging them
1. To maintain an attitude of unbiased, suspended judgment or conclusion,
 2. To criticize each suggestion,
 3. To be systematic in selecting and rejecting suggestions, and
 4. To verify conclusions.
- IV. Get them to *organize* their material so as to aid in the process of thinking by encouraging them
1. To "take stock" from time to time,
 2. To use methods of tabulation and graphic expression, and
 3. To express concisely the tentative conclusions reached from time to time during the inquiry.¹

DIFFERENCES IN THE THINKING OF ADULTS AND OF CHILDREN

All human beings think, but vary greatly in both the extent to which they think and the accuracy of the thought processes. The subnormal or feeble-minded individual thinks, but the amount and quality of his thought processes are greatly inferior to those of the normal being.

Children think less than adults because of the limited number of experiences and relations of experiences which they have had. An extremely bright child gifted with the power of concentration, attention, and observation may think far more than some normal adults. The dull child is one who is unable to see many relationships or interpret experiences. Children use mechanical memory a great deal. They have very few logical systems of ideas and possess only a limited fund of percepts and images, all of which are necessary for thinking.

¹ S. C. Parker, *Methods of Teaching in High Schools*, pp. 199-200. Ginn and Company, Boston, 1920.

Another reason why children do not think as much as adults is that teachers and parents do not give them the opportunity. The line of least resistance on the part of teacher and parent is to do the thinking for the children rather than to guide them in the process. A child learns to think by thinking and not by having someone else do it for him. Many children show ability to think when called upon to solve their own problems outside of school. The same children under the control of an unsympathetic teacher will substitute verbal statements, having merely the appearance of thought, for thought itself. If thinking is directed toward the solution of real problems, it is pleasant and satisfying. It will appear worth while, and children and young people will do more of it. Thinking, like all learning, should be accompanied by a feeling of satisfaction. There are distinct stages of preparation and readiness for the act of thinking.

Dewey has summarized these under the following five steps:

1. A felt difficulty.
2. Its location and definition.
3. Suggestion of possible solution.
4. Development by reasoning of the bearings of the suggestion.
5. Further observation and experiment leading to its acceptance or rejection; that is, to the conclusion of belief or disbelief.¹

Children will think if faced with problems; and since all school subjects can be arranged in problem form, it is possible to use every school subject as a means of stimulating thinking. Mere imitation and rote learning are not conducive to thinking. Originality and reflective power come only with the solving of problems. Deductions are made

¹ Dewey, *How We Think*, p. 72.

from the results of these solutions. Children readily think of the relationship of similarity and difference and of that of time and space. The trained adult can go beyond these relationships to the difficult relations of abstract cause and purpose.

Adults, who have had a wide experience and who have acquired information through many methods and channels, think more accurately than children do. The background of child life is of necessity limited. Children have not learned to discriminate, and therefore their conclusions and deductions may be extremely inaccurate. Accurate thinking requires information on every phase of a problem. The ability to think around a problem as well as through a problem, and to see it in all its relationships, comes, if it comes at all, only after years of study and experience. The attention on the part of the adult to concepts and relationships is much better than that of the child. The narrowing of the field of consciousness to one point and the inhibiting of all counter influences come as a result of growth and development. The child turns quickly from one concrete experience or thought to another. Children lack a critical attitude because of their inexperience in judging conditions, whereas the adult, out of his multitude of experiences, is able to judge what is right or wrong, true or false. Thinking is a complex process, involving all the types of mental states and processes. Complete thinking comes only after years of experience, and there is a question whether human beings ever attain perfection in this art.

TRAINING IN THINKING

Independence in thinking, not dependence, should be the ultimate aim of the school. The school should train children to think effectively. The traditions, superstitions, and preju-

dices which characterize much of adult thinking should be eliminated, and a child should be taught to recognize problems, to see each problem in its entire setting, and to recognize the relationship between the problem in hand and all the factors involved in every angle to which it penetrates or ramifies. Problem-solving is essential to training in thinking. The mere acceptance of facts when stated by another does not involve thinking: doubt must enter; the questioning attitude should predominate. Coleridge says:

To educate is to train to think, for by active thinking alone is knowledge attained. Without active thought we cannot get beyond mere belief, for to pass from belief to knowledge means to sift and weigh evidence for oneself. . . . Alas, [he exclaims further] how many examples are now present to my memory of young men the most anxiously and expensively be-school-mastered, be-tutored, be-lectured, anything but educated; who have received arms and ammunition, instead of skill, strength, and courage; varnished, rather than polished; perilously over-civilized, and most pitifully uncultivated! And all from inattention to the method dictated by nature herself, to the simple truth, that as the forms in all organized existence, so must all true and living knowledge proceed from within; that it may be trained, supported, fed, excited, but can never be infused or impressed.¹

Training in thinking requires the opportunity for analyzing, selecting the significant problem in a situation, testing conclusions for their validity, and forming the habit of supporting the conclusions reached.

QUESTIONS

1. Has your ultimate aim in education always been the same? Explain.
2. What is meant by coherent ideas?

¹ F. E. Bolton, *Everyday Psychology for Teachers*, p. 272.

3. When does thinking take place?
4. Show how reasoning is a form of learning.
5. Differentiate concrete and abstract learning.
6. Illustrate inductive learning; deductive learning.
7. Illustrate inductive teaching; deductive teaching.
8. What is a judgment? How is it formed?
9. When a teacher tells a boy to go to his seat and to think over the problem, what does she expect him to do? Why? Does he do it? Why?
10. What is meant in this chapter by *thinking*? Why is this definition of importance for a teacher?
11. Explain: "Perceptual thinking is basic."
12. What could you do to help a pupil who had difficulty in thinking in abstract terms?
13. Should young pupils be encouraged to reason by analogy? Why?
14. Why is it not advisable to use reasoning by disjunction in teaching elementary school subjects?
15. Restate in your own words Dewey's five steps in thinking. Apply this scheme of analyzing "the act of thinking" to a concrete situation.
16. Make a list of at least five important differences between the thinking of children and that of adults. What specific uses could a teacher make of such a list?

REFERENCES

- CARR, HARVEY. Psychology, Chap. IX. Longmans, Green & Co., New York, 1925.
- DEWEY, JOHN. How We Think. D. C. Heath & Co., New York, 1910.
- GIFFORD, WALTER J., and SHORTS, CLYDE P. Problems in Educational Psychology, Chap. VII. Doubleday, Doran & Company, Garden City, 1931.
- OGDEN, R. M. Psychology and Education, Chap. XVI. Harcourt, Brace and Company, New York, 1925.
- PARKER, S. C. Methods of Teaching in High Schools, Chap. IX. Ginn and Company, Boston, 1920.

- SKINNER, C. E., GAST, I. M., and SKINNER, H. C. Readings in Educational Psychology, Chap. XV. D. Appleton and Company, New York, 1926.
- TROW, WILLIAM CLARK. Educational Psychology, Chap. IX. Houghton Mifflin Company, Boston, 1931.
- WHEELER, R. H., and PERKINS, F. T. Principles of Mental Development, Chap. VIII. Thomas Y. Crowell Company, New York, 1932.
- WOODWORTH, R. S. Psychology (Revised), Chap. X. Henry Holt and Company, New York, 1929.

PART THREE · *Measurement of Behavior*

CHAPTER XIV

MEASUREMENT OF INTELLIGENCE

An important movement in psychology and education since 1890 is the measurement of human traits and abilities in terms of both quality and quantity. Many investigators have thus contributed to our knowledge. Wundt contributed much to the making of psychology more scientific, and trained many students in laboratory techniques. Ebbinghaus, Meumann, Radosavljevich, and many others have studied memory by experimental methods. Cattell has devised and used mental tests, and he too has trained many men who have added very materially to the science of psychology. Galton, at an earlier period, studied individual differences and imagery. Binet, after experimenting with mental tests, devised a general test of intelligence which has undergone many revisions. Thorndike's and Terman's measurements of individual differences are also notable. Thus the measurement movement has progressed. Both unlearned traits and capacities and learned abilities have been subjected to objective investigation. Certain aspects of personality, character, and achievement are relatively easy to measure. Other aspects present difficulties that are only partially surmountable at present; but as we progress they may yield to measurement.

The theory that many of the elements of behavior are so objective as to yield readily to analysis and measurements

underlies the entire movement of mental testing. It was believed for a long period that mental activity was too complex for measurement. In recent years tests of mental functions have become very common. Large numbers of such tests are now given annually to school children. They have proved a very effective means of promoting a scientific attitude toward education. The study of individual children and the recognition of individual differences have been greatly fostered. The tests have thrown much light on the problems of school efficiency in the matters of curriculum, organization, and methods. There are two classes of mental tests which are of chief interest to educators: tests of specific psychological functions and general intelligence tests. There is no abrupt break between these, for they overlap in many ways.

TYPES OF PSYCHOLOGICAL TESTS

Specific tests. The earliest types of measurements grew out of experimental work in the psychological laboratory. The experimental psychologist has formulated methods which could be applied to many aspects of mental life, such as sensations, reaction time, percepts, associations, memories, emotions, and images. He has developed intensive tests in each of these fields. It was found that the keenness and discriminative power of some of the senses could be measured with a higher degree of accuracy than the more complex thought processes.

Physiological and psychological tests may show poor school work to be a result of sensory defects, such as astigmatism, near-sightedness, or defective hearing. Tests which reveal the degree of ability to discriminate tones of different pitch or loudness will give information for pupil guidance in music. A knowledge of the child's attentive ability, his

motor control and steadiness, his faculty for forming associations, and other mental abilities is also of value to the teacher. In the case of mental abilities that may be isolated, quantitative measurements are possible, but the testing of some of these traits is a complicated process. The crossing out of A's on a printed page is a "perception test," but the rate and accuracy of such work also depend greatly on keenness of sight, visual span, reaction time, motor control, and habits of attention.

Some attempts have been made to make psychographs, or profiles, of the mental life of individuals by recording the relative position which they occupy above or below the norm, or average, for the same age, grade, or social group.

Intelligence tests. The extensive and intensive work with tests of a single ability made possible the development of tests of general mental ability. These consist of systematic groupings of single tests arranged in such a way as to give a summary survey or measure of mental behavior. The purpose of this type of test is to give a cross-section view of mental life or power at the time. It has never been determined exactly what specific phases of behavior portray most adequately the entire mental ability; therefore the makers of tests do not agree as to content. All seek a variety of test materials so that a wide range of interests, powers, and abilities may be examined. The assumption that an individual's mental capacity will reveal itself in responses to various situations underlies the planning and use of this type of test. Chance situations develop too slowly to be effective, and for this reason the test-makers have organized many different situations in a systematic way, so that records can be kept of the number of successful reactions made under controlled conditions.

The notion has unfortunately developed that these tests are measures of absolute and fixed native capacity. So

many factors of a psychological, social, and environmental type are operative from the moment of birth it would be extremely unsafe to say that it is possible to obtain an index of the capacity, potential and actual, which anyone possessed at birth. Granted that one has experienced a normal environment and that the neural structure with which one was born has had a free and normal development, the reactions which one gives may be considered a fair index of native ability. Of two children, one bright and the other dull, subjected to exactly the same environment throughout life and having identical experiences, the former will absorb a rich fund of details which will make little impression upon the duller child. The former also will learn to react quickly and accurately to many situations, whereas his companion will be found generally slower and more inaccurate as well as less responsive.

Early interest in the intelligence tests had to do almost exclusively with the feeble-minded, especially with institutional cases who could not be taught in the ordinary school. The tests are now used to discover and analyze the exceptionally bright, the average, and the subnormal child.

The use of the term "intelligence test" implies that what is meant by intelligence is fairly well known. The term is variously defined by different authorities. Some emphasize the ability of the intelligent person to solve new problems or to adapt himself to relatively new situations; others consider the power to think abstractly as the distinctive characteristic. The ability to perceive readily and accurately, to associate symbols or ideas, to remember, or to reason are variously emphasized as marks of intelligence. Ability in language is regarded by some as most significant. The test-makers attempt to organize the material so as to deal with most of these functions and thus satisfy the requirements of authorities. No test should be called an

intelligence test unless it has been found a valid measure of intelligence. It must present items of a steadily increasing difficulty for successive ages, and its results must be in fair agreement with commonly accepted standards, such as success in school work or in life activities and the judgments of associates who have had long experience with the individuals tested.

The intelligence test is of two main types, the individual test and the group test.

1. *The individual test.* The individual test had its origin with the work of Binet and Simon in 1905. This test was made up of thirty single tests arranged in a given order. It was used as a "point test," points of credit being given for each test passed. The test was reorganized in 1908 and again in 1911 into an age scale, with a certain number of tests appropriate for each age. The child showed his ability at any stage of difficulty by passing the majority of tests for that age. His Mental Age (M.A.) was determined by the number of tests he was able to pass.

Several revisions of the Binet test have been made in the United States. In all of these the test items have been rearranged in the scale, and the test has been better adapted to national needs and standards. It has also been extended downward to give a measure of the mental ability of young children and extended upward to give an index of mentality for the superior adult. More refined methods of scoring and grading of mental age in terms of months have been developed. Two revisions that are point scales are the Yerkes-Foster Revision and the Herring Revision. In point scales the test items are arranged in order of difficulty. A certain number of credits or points are then given for the successful passing of each test. The total number of points scored by the individual is then divided by the norm for his age, and his coefficient of mental ability (or, on the

Herring Scale, his M.A. or I.Q.) is determined. The Goddard, Kuhlman, and Stanford revisions have followed Binet's later method by using the age scale. The Stanford Revision, so called because it was developed by Terman at Stanford University, was the first test to make use of the Intelligence Quotient, a device suggested by Stern in Germany. The I.Q. is a number expressing the percentage ratio between the individual's mental age (M.A.) and his actual or chronological age (C.A.). Its value is $M.A./C.A.$ The normal child of a chronological age of ten years and two months would have a mental age of ten years and two months. His intelligence quotient would be $122/122 \times 100 = 100$, or average. If this child were shown to have a mental age of eight years and three months, or 99 months, his intelligence quotient would be $99/122 \times 100$, or 81. With a mental age of 12 years and 11 months, his intelligence quotient would be $155/122 \times 100$, or 127.

In the individual test very specific directions are given for administering and scoring the test as a whole as well as each item of the test. This insures uniformity of ratings. Only those who are especially trained for testing and adapted to it can be depended upon for reliable results.

2. *The group test.* The individual test requires about an hour for each subject; the group test makes it possible to examine the members of a large group in the same length of time. The group test is generally recognized as less accurate than the individual test and is used as a means of roughly differentiating the bright and dull pupils. A more thorough analysis can then be made of special cases by the use of individual tests.

The first extensive use of group tests of intelligence was during the World War, for the purpose of selecting men for the service and for promotion. The Army Alpha Test was designed for those who could read; the Army Beta Test, for

those who were unable to read. The latter was administered by means of gestures and charts. After a thorough and fairly successful use of preliminary tests, prejudices against group testing were overcome and group tests were developed in a great variety of forms. In the school field their use extends from the kindergarten to the university, inclusive.

In some cases a variety of forms of the same test are provided, all of equal difficulty, so that on successive applications there is less likelihood that results will be affected by memory of test content.

The material that goes to make up the group test is organized in ways such as are illustrated in the following examples, selected at random.

Completion. Write on each dotted line one word to make the sentence sound sensible and right:

1. The ball is
2. Frogs swim the water.

Same-opposite. If two words mean the same, write *S* on the dotted line between them; if they are as different as can be, write *D* between them:

1. Yes no.
2. Son daughter.
3. Light bright.

Information. In each sentence draw a line under the one word that makes the sentence true:

1. The number of months in a year is (five — six — seven — twelve).
2. Cheese comes from (butter — plants — eggs — milk).

Analogy. Read carefully the first three words in each line; then read the last four and draw a line under the right one:

1. Baby : cries :: cat mews hole little dog
2. Dog : hair :: fish cat water scales pole

Number completion. In the lines below, each number is obtained in a certain way from the numbers coming before it; study out what this way is, in each line, and then write in the space left for it the number that should come next:

1. 20 24 28 32 ---
2. 74 76 77 79 80 82 ---

The results of group tests are treated as points. In most cases these may be transmuted into mental ages, and I.Q.'s may be computed. The scores made on a group test are hardly comparable with those of other group or individual tests, since few of them have been equated and the reliability of the group tests is relatively low.

Performance tests. A special type of intelligence test is known as the performance test. This may be of the single-test or the group-test form and may be applicable to the individual or to the group. Performance tests are designed for use with those who have difficulty with language, such as the deaf, the illiterate, or the foreigner. Directions may be given orally or visually by means of diagrams and by movements which may be imitated. A form-board is a very ingenious device of this type. There are holes in the board which may be filled with pieces of various shapes. The method used by the subject is as significant as the time taken in solving the problem.

STANDARDIZATION

Tests are either standardized or unstandardized. A standard test is one which meets the following conditions:

1. *Standard subject matter.* The content of the test must be valid, being so selected that it is suitable to the purpose in mind. It must actually test the function which it claims to measure. A test of reasoning would not be valid if the

subject matter of the test was of such a nature as to require only verbal memory of the material.

2. *Standard organization of content.* The test material may assume a variety of forms. It may be made up of completion tests; true-and-false, right-and-wrong, or other alternative-choice tests; recognition tests, in which the right answer is checked or underlined; or some combination of forms. The test proper may be preceded by exercises to give the subject an opportunity to become acquainted with the methods used. The tests or test items may be arranged in order of difficulty along a mathematical scale.

3. *Standard method of administration.* Each test has its specific directions, which must be followed by the one giving the test. These directions are adapted to the particular needs of the test and the age of the subject. The directions involve not only the method and the language used in presentation but also the time. It is evident that a slight variation in either may result in a marked variation in the returns. One can successfully administer a test only after a thorough mastery of techniques. This is true of group tests as well as of individual tests, although the latter require much more training for mastery.

4. *Standard method of scoring.* In order that the test may be objective, the correct answers are given in a key. Personal opinion and possible error are eliminated as far as possible by this method. The one who scores the test does not make any exception to the key because of sympathy for the pupils. Various devices are used to make the scoring rapid and accurate.

5. *Standard norms of performance.* This is the most important of all the factors of standardization. Unless norms are established, the test cannot be regarded as standard. The norms for a test are usually given in terms of one of the averages. They show the grades which are made by large

numbers of people, and are ordinarily expressed in terms of age or grade, or both. The norm must be reliable if it is to be used for purposes of comparison. Reliability of the norm is secured by giving the test in its final form, following the standard directions for giving and scoring, to a random sample of the population for the respective ages or grades. Random sampling necessitates the selection of a large enough number of representative cases so that the addition of other cases will not appreciably affect the average or the form of the distribution.

6. *Standard methods of interpretation.* When a standard test has been given to a group, the score of any individual or the average score of the entire group may be compared with the corresponding norms for the test. Full instructions for interpreting the results are included with each standard test. For example, the manual for the Otis Self-Administering Tests of Mental Ability provides interpretation charts by which any given score made by pupils of various ages may be quickly transmuted into the corresponding mental age, I.Q., Index of Brightness, percentile rank, or classification. The examiner notes the child's score and his age and then traces the curved line which passes through the junction of these two values on the chart to its terminus on a scale at the right, where the desired indexes are given. Detailed instructions are given as to the computation and interpretation of statistical values used, such as the median, interquartile range, and percentile rank. The method of constructing percentile curves is also presented. Data regarding the validity and reliability of the test are appended.

Prognostic tests. Prognostic tests are planned to give an insight into an individual's ability to engage in a particular line of activity with success. The general intelligence test may be regarded as prognostic to the extent that it is

predictive. When it is used as a means of selecting college entrants or of classifying pupils according to ability, the assumption is made that the test results make possible a prophecy of the success or failure of the accepted or rejected groups. Mechanical-aptitude and musical-talent tests belong to this type.

SPECIAL VALUES OF TESTS FOR EDUCATION

1. *Classification.* Tests have been used as an administrative device to help effect a classification of pupils in the grades into superior, average, and below-average groups, so that each of these will be relatively more homogeneous in ability.

The advantages of such an arrangement are fairly obvious. The more capable pupils are given work adapted to their level of intelligence. Those of less ability may have work graded to their particular needs, and special studies of their disabilities may be made. With proper care that the pupils are not made so conscious of their classification as to become either unduly proud or discouraged, and with some consideration of grouping according to special talents and disabilities, social interests, and age needs, the plan may be effective. There are also certain disadvantages in the practice. Modern improvements in school procedures make formal classification or class sectioning of pupils largely unnecessary.

Intelligence tests have been used extensively as a basis of such classification or sectioning of classes. The original scores on the test either are in terms of mental age or are transmuted into mental age. Some authorities believe that children of the same mental age should be together in school work. They consider this a more appropriate single basis of classification than the chronological age.

The intelligence quotient of pupils within a given age

or grade group is often employed as a supplementary consideration. Not merely the child's present ability but also his ability relative to his age is hereby taken into account. Two children, one eight years old and the other twelve, but with the same mental age of ten, placed together in a class, should not be expected to do the same work. They may be in agreement for a short time, but they represent two different types of mental ability. The former will normally progress much more rapidly and will soon leave his older companion behind. This necessitates a readjustment.

No school classification can be adequately made which neglects the progress of children in school subjects. The child with a high mental age or intelligence quotient may have failed to master certain very important school activities. Promotion in these subjects is sometimes justifiable, even though the pupil has not actually mastered all the detailed skills and knowledges.

2. *Educational guidance.* Steps are being taken toward discovering the pupil's interests in subjects and determining his ability to master these subjects. The child's ability to handle an enriched subject matter or the mere essentials of a subject is taken into account. If a pupil of the freshman year has the comparatively low intelligence quotient of 80, there is very little likelihood of his being able to complete his work in high school. If he fails in freshman algebra, it may be a waste of time for him to repeat the subject. Educational guidance involves in part the placement of the student in activities suited to his capacities, talents, and abilities.

3. *Vocational guidance.* The task of giving children specific guidance in vocational lines is still in its initial stages. The inability of a child to undertake certain vocations can be partly ascertained through the medium of intelligence, educational, and aptitude tests, and he can then be urged

to consider other possibilities within his range of ability. A high-school pupil with an intelligence quotient of 80 and a record of repeated failures in mathematics and the sciences desires to be an engineer. It is evident that he does not possess the qualifications for this highly specialized work, for even with all incentives to improvement he does not improve. He may become a builder or a contractor, for he has ability to handle tools and gives evidence of business leadership. Mental tests are employed only as one phase of analysis in any good plan of prevocational guidance.

4. *Diagnosis.* Diagnostic mental tests are devised for a detailed analysis of individual performance in particular traits or abilities. The test content is so arranged that the specific weakness of the individual may be discovered. The individual intelligence test, such as the Stanford-Binet, is often used, and the results interpreted in this manner. A child twelve years of age and in the third grade is found to have the mentality of a nine-year-old child. An analysis of the results shows that he has exceptionally poor imagery, since he fails to pass the tests which emphasize this ability.

Special mental tests have been constructed to measure such traits and abilities as language resourcefulness, memory, motor learning, mechanical ability, construction ability, imagination, memory, reasoning, and the like. Through the use of such tests, one obtains a picture that frequently demonstrates the individual's weak and strong points in mental capacities and abilities.

Growth of intelligence. It is commonly assumed that the amount of actual working intelligence increases with age, from birth to maturity. Rate of growth is comparatively rapid in the early years, with a slowing down in the rate in later adolescence. Mental power seems to increase up to approximately the age of eighteen to twenty-one. Many psychologists believe that growth in mental power ceases

at sixteen years or even as early as fourteen years, and possibly below these years. The loss in general ability from twenty to fifty years appears to be slight except in such minor matters as speed and quickness of response. The ordinary intelligence tests do not measure all the mental functions. Future research is needed on this point. The curve of mental growth resembles very much the curve of physical growth. The individual who has a low grade of ability makes less rapid progress and reaches the limit of mental maturity earlier than the superior and average individuals.

Constancy of the intelligence quotient. The reliability of the intelligence tests depends to a great extent upon their power to yield an intelligence quotient which will be approximately the same on successive retests. Intelligence tests can safely be used for predictive purposes only when there is a fair degree of constancy in this measure. Terman reports many instances in which the intelligence quotient is shown to be fairly constant. He also cites some cases which showed irregular development, two of which were caused by mental disease. The individual intelligence test is not extended far enough into the upper years to provide for tests of constancy among the brighter individuals. The child who passes all the tests of the Stanford Revision at the age of twelve receives an intelligence quotient of 162.5. The passing of all the tests four years or more later yields an intelligence quotient of only 122. One cannot infer that the actual intelligence quotient has decreased, but only that the test does not indicate the quotient properly. Certain other authorities cite rather wide variations in the intelligence quotient. For most individuals it may vary at the most about seven to eight points. In exceptional cases the I.Q. may vary 20 or even 30 points. The group tests do not show as great a degree of constancy as do the individual tests.

Classification of intelligence. There are various classifications for administrative purposes based on mental age and intelligence quotients. The mature individual who has a mental age of from 0 to 2 years is classed as an idiot; one with a mental age of from 2 to 7, as an imbecile; and one with a mental age of from 7 to 10, as a moron. With the individual whose mental age is constantly increasing another index is required. A classification generally in use but not free from serious criticism is as follows:

I.Q.	CLASS
130 up	Very superior
120-129	Superior
110-119	Fairly bright
90-109	Average
80-89	Backward
70-79	Borderline
Below 70	Feeble-minded ¹

QUESTIONS AND PROBLEMS

1. What is the nature of intelligence?
2. What assumptions underlie the construction of intelligence tests?
3. What factors influence the results obtained by intelligence tests?
4. Does the individual have one general intelligence or many intelligences?
5. How are the M.A. and I.Q. found?
6. Should children know their I.Q.? Why or why not? Should the teacher know the I.Q. of her pupils? Why or why not?
7. Can pupils be classified into homogeneous subject-matter ability groups on the basis of intelligence tests? Why or why not? What dangers attend the homogeneous grouping of pupils? What alternative can you suggest?

¹ Provided the individual is unable to make sufficient social and economical adjustments so as to get along in the world.

8. Of the several uses of intelligence tests, which is the most important — classification, diagnosis, guidance?

9. Is the I.Q. constant? If not, what factors probably influence its variation?

10. Assume you are a teacher in the fifth grade; tell what mental tests you might use, for what purpose, and just what you would do with the findings.

11. Should teachers drill pupils on content of intelligence tests? Why or why not?

12. Distinguish between general intelligence tests and aptitude tests; between diagnostic tests and prognostic tests.

REFERENCES

- BURT, CYRIL. Mental and Scholastic Tests. King and Son, London, 1921.
- DEARBORN, W. F. Intelligence Tests. Houghton Mifflin Company, Boston, 1928.
- FREEMAN, F. N. Mental Tests. Houghton Mifflin Company, Boston, 1926.
- OGDEN, R. M. Psychology and Education, Chap. XVII. Harcourt, Brace and Company, New York, 1926.
- PINTNER, R. Intelligence Testing. Henry Holt and Company, New York, 1930.
- PROCTOR, W. M. Educational and Vocational Guidance. Houghton Mifflin Company, Boston, 1925.
- SKINNER, C. E., GAST, I. M., and SKINNER, H. C. Readings in Educational Psychology. D. Appleton and Company, New York, 1926.
- TERMAN, L. M. The Measurement of Intelligence. Houghton Mifflin Company, Boston, 1916.
- THURSTON, L. L. The Nature of Intelligence. Harcourt, Brace and Company, New York, 1924.
- WELLS, F. L. Mental Tests in Clinical Practice. World Book Company, Yonkers, 1927.
- YERKES, R. M., and FOSTER, JOSEPHINE. A Point Scale for Measuring Mental Ability. Warwick and York, Baltimore, 1923.

CHAPTER XV

EDUCATIONAL MEASUREMENTS

The development of educational tests has been coincident with that of intelligence tests, and the two movements have been more or less related. Most of the educational tests have been constructed by educational psychologists, and it is not uncommon to find the psychologist formulating both types of measurement.

The purpose of the educational test differs from that of the intelligence test in that it attempts to measure the actual achievement or level of progress of a child in a particular school subject, rather than the potential ability of the individual. It emphasizes actual knowledge or skill in a specialized field or subject of study rather than general knowledges and skills which differentiate varied levels of mental ability.

THE DEVELOPMENT OF EDUCATIONAL MEASUREMENT

From ancient times to the present teachers have rated the work of pupils on the basis of subjective estimates. The first definite suggestion for an objective rating method was that given by Rice in 1897 in his report of a standard object test in spelling. This attempt was subjected to much ridicule by the educators of the period. Twelve years later (1909) Courtis's Arithmetic Tests and Thorndike's Hand-writing Scale were issued. Since that time the standard achievement tests have been developed in great numbers and in many forms. Practically every subject of the elementary and secondary school levels is now subject to

measurement by means of such tests. Needless to say, the attitude of educators has changed from ridicule to one of glad acceptance and coöperation.

The early part of the period of development was characterized by the multiplication of measuring devices. The emphasis has been shifted somewhat during recent years to a refinement of such tests, the securing of more exact norms, and the making of more practical and accurate interpretations. Details regarding the present tendencies will be noted under other headings.

THE NEED FOR STANDARD EDUCATIONAL TESTS

One of the factors which stimulated the movement toward the construction and adoption of standardized tests in subject matter was the growing recognition of the unreliability of teachers' marks. Many scientific investigations were carried on shortly after the introduction of the first tests which revealed very clearly certain facts which previously had been only vaguely conceived of by a few.¹ For example, a geometry test paper of a pupil was graded by a large number of teachers of the subject. The resultant grades were found to be scattered from below 30 per cent to above 90 per cent. The grades were found to be even more widely scattered on test papers in subjects which were less definite than geometry. Similarly, it was found that the teacher would seldom grade the same examination the same on two successive independent ratings; in fact, that the variation between such grades was often very great. The unreliability of teachers' marks may be explained by the fact that the teacher has no definite or exact estimate of the weight which should attach to any item of a test, either from the stand-

¹ W. S. Monroe, *Measuring the Results of Teaching*, pp. 2-20. D. Starch, *Educational Psychology* (Revised Edition), pp. 450-530.

point of its relative significance as compared with other items, or in terms of its comparative difficulty for the pupils.

These facts have local import in view of the fact that pupil marks are the determinants of promotion and failure, and often influence the granting of awards for scholarship. Scientific studies also called attention to the great overlapping of pupil achievement in the various grades of the school and showed very clearly that, because of the unstandardized systems of grading, children were being promoted in certain classes without the requisite background for such promotion, while in other classes some were retarded whose achievement entitled them to promotion.

With the rapid growth of schools and school systems, there was a growing demand for comparison of the work done by various classes, grades, and schools within a school system as well as of the achievements of various school systems. It was clear that no such comparison could be made on the basis of teacher marks alone. School superintendents found it impossible to evaluate the progress being made by any class or grade without the aid of standardized tests, or to compare the work being done in one system with that of other school systems. Only with the advent of these tests did the school survey become possible.

During this period there was a growing demand for real economy in the administration of all business and particularly of the public institutions. The school superintendent found it more and more incumbent upon him to discover the efficiency of the various units under his care and to bring them to the highest state of efficiency possible. With the introduction of the standard achievement test, he was enabled to measure the educational outcomes objectively and to detect those aspects of the work which were in need of special attention. The improvement of the schools by the use of standardized tests forms a notable chapter in

general school progress.¹ Improved teacher training, higher standards of teacher selection, the adoption of better methods of instruction, the establishment of new and more definite goals, and the revision of curricula are some of the recent movements which have been largely stimulated by the widespread use of educational tests.

Gradually the teachers began to realize the values of the tests for their work. An early prejudice against the tests was more and more dissipated. Teachers began to demand and to use the tests as a means of analyzing classroom needs and of securing improvements in procedures which would yield better results.

Research in educational psychology has fostered, and has been greatly stimulated by, the development of educational measurements. Classroom experimentation, which had not formerly been possible, has become frequent. The analysis of the mental processes of the learner in specific subject matter was made more fruitful, and methods of teaching have been evaluated systematically, with consequent recommendation and adoption of more economical procedures.

TYPES OF DEVICES FOR MEASUREMENT

There are many bases for the classification of educational tests, such as purpose and function, form of organization, and degree and procedure of standardization. The latter point is here considered.

Standard achievement tests. It has been the objective of test-makers and publishers to present thoroughly standardized tests for school use. In some cases this objective has not been fully achieved; but the tendency has grown, and only those which approximate the ideal are being accepted and used in the work of school surveys. Those which

¹ S. S. Brooks, *Improving Schools by Standardized Tests*.

have not been standardized adequately seldom gain or hold popular approval, since the measurements thus secured are recognized as undependable for comparisons.

Most of the standard achievement tests devised are of the single-subject type, such as an arithmetic test, a spelling test, or a reading test. The first step in the procedure is to determine the content of the test and to establish its validity. The method of doing this differs somewhat for the various subjects, but in general an analysis is carried on which reveals the knowledges and skills that may be considered essential in carrying on the work of the particular grade level or levels with which the test is concerned. After this material is selected, it is organized in the form desired and administered to many thousands of pupils well distributed over the country. The average scores (means or medians) made by this large number of children in each grade or age are then established as norms. One index of the reliability of the test is whether it reveals a steady increase of averages from one grade to the next, or throughout the various age levels.

Although certain subjects with specific knowledge or skill content are readily susceptible to measurement by standard tests, others offer difficulties. This is especially true of those subjects which have no generally accepted body of specific material. The newer subjects of study, such as natural science, and those which are in a constant state of reorganization with varying local emphasis, such as history, present problems which make difficult any exact validation of the standard test in such fields. This fact explains the relatively smaller use of tests in high school than in elementary school and the almost complete lack of such tests on the college level.

Achievement tests are sometimes conveniently organized in test batteries, with all the basic subject-matter tests for

the elementary grade level for which they are suited bound together. Scores for each test of the battery or for the whole test series are interpreted on the same base scale of norms in terms of the age or grade progress of ability for each child. Such a test battery, when combined with a group intelligence test, is sometimes known as an "omnibus" test. Tests of these types must be taken by pupils in several test periods, with enough rest between periods to prevent undue fatigue and a consequent failure to secure the pupil's true score.

Certain types of subject matter, such as handwriting and English composition, are measurable only by the introduction of subjective judgment. In this case, scales of work representing definite steps, or grades, of quality as found by the judgments of experts in the field are set up as models by which the individual work of each pupil is to be evaluated. Although the test-user must make a somewhat subjective estimate of the value of the specimen of the pupil, he is able with some practice to make ready comparisons and to assign scores which are much more reliable than would be the case without the aid of the scale.

Diagnostic tests. A special type of test increasingly approved of by teachers is the diagnostic test. As a rule it deals with a certain specific topic within the subject and selects the items appropriate to the school level being considered. Thus, a test of compound fractions or of percentage may be given to pupils of the seventh grade. The same type of exercise is repeated several times among all the items. If a pupil fails in this exercise every time it occurs, there is convincing evidence that he is in need of drill at this point.

Although the diagnostic test may be used as a survey of the school system at a particular level, or stage, of work, its primary purpose is in classroom guidance for the specific help of the teacher. A chart of the results may be drawn up somewhat in the following manner:

PUPIL	ITEM NUMBER																		TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Alden	/				/				/			/		/				/	6
Bell					/			/				/				/			4
Busch																			0
Carter	/			/	/				/	/		/		/		/		/	9
Etc.																			
<hr/>																			
Total . . .	6	2	0	4	15	0	0	1	7	12	0	21	1	10	3	9	0	18	

Such a tabulation will reveal to the teacher immediately those pupils who have a mastery or near mastery of the topic, as well as those who make many errors. It will furthermore depict very clearly which aspects of the topic need further drill in the case of individuals, groups of individuals, or the class as a whole.

Prognostic tests. Prognostic tests, which are designed to predict the ability to learn a particular subject, have been devised in a few subjects; but these have never enjoyed great favor, largely because the error of prediction is so large as to be very hazardous. Such a test in the foreign-language field undertakes to examine the individual in those grammatical elements which are essential to success in the study, and to present the elements of the language to be studied or of an artificial language, together with basic vocabulary, rules, and forms, testing the ability of the individual in the application of these elements to translation. It is evident that one cannot predict from such a test how earnestly one may apply himself to the study once it is undertaken, to what extent basal deficiencies may be overcome, or how one will meet difficulties in the later stages of the study.

Unstandardized tests. In recent years there has been a marked movement in the way of encouraging and stimu-

lating teachers in the use of "new-type," unstandardized tests. It is recognized that no standard test, however well conceived and planned to include the basic elements of any subject as taught in the country as a whole, can provide for the testing of those local variants in content or specific elements which may be emphasized in particular courses of study. Only the supervisors of teachers concerned are fully aware of these conditions. It is often true that the standard test in a subject is not applicable in a local situation, in which the topics of a subject are treated in a different order or in different grades than is the case with the test itself. In addition, the tests cannot be presented in such detail as to provide standardized testing for any specific lesson which may be given.

In all such situations the unstandardized test, locally constructed by the teachers or supervisors concerned, will prove of value, either for the comparison of classes, grades, or schools within the school system or for the guidance of the teacher in relation to specific topics or lessons. Such a test may be of the survey or of the diagnostic type. It may deal with a broad aspect of the subject or subjects concerned, or it may be a thorough and detailed test of a particular lesson with a view to discovering the degree of mastery which the class or individuals in the class have gained. It is evident that highly standardized norms are not needed unless the comparisons are to be more than local in character. Local norms may be developed which will be adequate for local comparisons, especially as a means of studying the progress of pupils from one period to another.

It is strongly recommended that such new-type tests be modeled in form, organization, methods of administration, and scoring procedure on the plan of acceptable standard tests. The primary requisite is that they be objective, so that mere estimates and judgments may be ruled out. The

value to be gained in the way of increased interest and efficiency on the part of teacher and pupil more than offsets the amount of work involved. Every school should be equipped with apparatus for making duplicate copies, though on occasion the test items may be placed upon the blackboard or presented orally to the class.

The essay type of examination may be preferable for certain types of material. One criticism of the "objective" test is that little room is allowed for originality of expression or organization. The main body of ideas is provided by the test-maker, and all that the one tested has to do is to write in a word or to check the right answer among alternative answers which are listed. This procedure gives no real opportunity for free expression. One may be able to identify correct answers in a routine way and yet be unable to think of these responses if he must act upon his own initiative or to plan his response in any systematic way. The object of testing must sometimes be to discover the pupil's ability to think his way through a problem rather than merely to demonstrate his mastery of elements which are largely matters of rote memory.

The essay test is not one which ordinarily yields itself to exact and objective scoring. A little care in planning the test will, however, make the test scores relatively reliable. Certain best answers for each test item are desirable. These answers should be expected to contain certain definite points, possibly to be arranged in a certain order, or to be arrived at by a certain logical sequence. These best answers, known to the teacher, are then evaluated carefully in terms of point scores. The student's answer for any item is then analyzed and graded in terms of the number of points covered as compared with the key. Such procedure prevents the examiner from being misled by such characteristics in the response as free verbal expression and

long answers, generalities, vague and indefinite statements, and special emphasis upon one point alone out of many which should have been mentioned. There is a fairly close correspondence between the scores on an essay test thus planned and a new-type test covering the same field. Students often prefer the essay test because they are under the impression that they can do better on this type of test. As a rule, however, they reveal the same relative degree of knowledge of subject matter in one case as in the other. In fact, the essay form may lead them to inexact responses, undue verbosity, and the placing of undue stress upon one phase of the answer.

TEST FORMS AND ORGANIZATION

In general, the objective achievement tests have followed the models found in intelligence tests. The former have indeed made use of a greater variety of forms of organization than have the intelligence tests proper.

Completion. The simplest type of completion test is that in which a sentence is written in an incomplete form with one or more blanks to be filled by the pupil. The pupil's success depends upon his mastery of specific items of information. The part of the statement supplied must itself give the cue to, and place the limits of, the answer to be given. "----- discovered ----- in -----" would be a test item which could be answered correctly in a great variety of ways; "Columbus discovered ----- in -----" would be much better because it sets up certain associations which direct the mind of the child to the correct answer "America" or "the West Indies." The last blank is not carefully guarded unless one indicates to what classification it refers. As given, "fifteenth century" or "October," or even "the *Santa Maria*" or "the Atlantic Ocean," would be

correct ; but if worded "in the year," there is no alternative. Psychological principles must govern the construction of tests of all types. One cannot fairly grade a pupil's answer as wrong unless the test form has made clear what answer is desired.

Variations of the sentence completion consist of blanks to be filled with names of places or objects, as employed with maps, or with figures such as are commonly used in science. Letters may be placed on the drawing, and on another place in the page or another page the pupil writes the answer in the blank opposite the same letters. Definitions of terms may be followed by blanks where the terms themselves may be indicated.

Recognition. In this form about four or five answers are given to a question, and the child is asked to check the correct one. One who may not be able to supply an answer may recognize the correct one among such a group. This form is an aid to recall in the sense that it renews associations which may have become somewhat dim in memory. One may grade the response in terms of points ; for example, 2 points for checking the right answer, 1 point for an answer which is almost right, 0 for a definitely wrong answer, and - 1 for an absurd answer. A modification of the form combines the completion test with it. In addition to the answers supplied, another line is added which is blank. Sometimes the correct answer is among those given and in other items it is to be written in by the pupil. Unless the child is very certain of the answer for any item, he will either fail to check the right answer if it is supplied, omit the writing of the answer in the blank, or write the wrong answer. The recognition test type is sometimes called the "alternate response" test. It is quickly given, is readily scored, and yields an objective grade. It is especially valuable for diagnostic purposes.

Association. This form consists of two lists which are related in some definite way. For example, one list may give the names of countries and the other list enumerate the products, or names of persons or events, which are associated with these countries. The items of the second list are numbered and are placed in mixed order with relation to their associates in the first list. The pupil is to place on the blank line in front of each item of the first list the number or numbers that indicate which items of the second list are associated with each item so marked. One must use care not to make the test too difficult. With early grades five or six pairs are not too confusing, but in the upper grades and high school ten to fifteen pairs may be used. A variation of the test which makes for increased difficulty, but which makes a more rigid test, is that of giving one or more extraneous items in each list, these being without pairs in the other list. The directions then state that some or all of them may be associated.

True-false. The true-false test is the one which is most commonly employed. In some respects it is the most unsatisfactory. The ease with which it is constructed, the economy of time and directions in administration, and the objectivity of scoring have stimulated its wide use. It is difficult to construct such a test and be certain that every item is entirely unambiguous. "Knowledge of one's own success in an undertaking stimulates one's most intense effort" is a statement which, as worded, is neither true nor false, since the principle will not hold true for all individuals in regard to all types of learning, however much it may characterize the work of some, and even though it be found to be true for average groups or individuals. Because of the simple chance factor involved, pupils are usually encouraged to guess the correct answer, and tests are scored in terms of "Right minus Wrong." Thus, in a test

of 40 items, the pupil who answers only 20 correctly receives a score of 0, while one who makes only one error is scored 38. Minus scores are disregarded. This procedure does not ordinarily change the relative ranking of pupils unless the true-false test is only one of several tests being given and scored together. Because of the fact that an individual may make a fairly good score by the process of guessing alone, without knowing the answer for any item, this type of test is recognized as being unreliable for arriving at individual scores, although the average scores for groups may be comparable.

A variation of the true-false test which discourages guessing and which makes for more reliable scores directs the pupil to place on the blank line following the reason why he marked the item true, or the correction of the item if he has marked it wrong. The response is marked right only if an adequate reason or correction is given.

SPECIAL COMMENTS ON TEST ORGANIZATION

Samples of the forms here listed are given in the exercises at the end of this chapter. Any of them may be used in the new-type unstandardized test. Although some forms, like the completion or recognition types, are especially adaptable to testing one's memory for factual materials and although all may be used to this end, the test content may be planned for the purpose of testing the pupil's ability to reason with facts which may be known to him or which may be placed before him. Such reasoning tests are more difficult to construct.

Every test of these types should be preceded by careful instructions, and special care should be taken that every pupil may know exactly what he is to do. Preliminary items for practice in following directions are practically essential

for any test form which is not very familiar to and understood by every pupil. Investigations have revealed that the scores of pupils tend to improve from test to test when these forms are used, merely because the pupils learn how to take the tests even though there has been no real increase in knowledge. In other words, individuals become test-wise in the sense that they master the technique of taking such a test and become more expert and facile in recording their answers. This fact calls attention to the difficulty encountered in securing exact differentiations of pupils who have had varying degrees of experience with the taking of tests.

Standardized tests often provide two or more equivalent forms of the same test. In organization such forms are identical, but the specific content of each is different. Each item or group of items given deals with the same topic and is of the same degree of difficulty in one form as in the other. The relative difficulty of the forms is determined by the results of widespread testing of many thousand individuals. Although the forms may be equally difficult on the average for pupils of the specific level, it cannot be assumed that they will be of the same absolute degree of difficulty for any particular group of pupils, or for those of different levels of progress.

Although the objective tests do not tend to stimulate cheating by pupils, it is possible for a pupil to copy the answers which his neighbor puts down. Different forms of the same test may be used as a preventive of such a tendency, each pupil being given a different form from any of the pupils around him. Two forms of the same test, with identical content, may be constructed by organizing the items of one test in an order different from that of the other.

There is some criticism of the objective test because it often violates the principle which states that only the cor-

rect form should be presented to the learner. This applies particularly to the true-false type. Occasional experiences of this type in the way of testing, especially when followed by remedial work, would have no retarding influence on learning. But the fact itself should warn against the too frequent use of such forms as emphasize this aspect.

SPECIAL TECHNIQUES OF TESTING

As a rule, achievement tests in education are scored in points. In the standardized tests these points are assigned a value in terms of the norms for the age or grade. A pupil who scores the same number of points on the test as the average child of a certain age is said to have the Educational Age (E.A.) corresponding. As a matter of fact, the various subjects are specifically designated by terms such as Reading Age (R.A.), Arithmetic Age (A.A.), and Spelling Age (S.A.), and the term "Educational Age" is reserved for the designation of a battery of tests or of the combined ratings of a number of subject tests.

As is the case with intelligence tests, a quotient is computed which relates the child's specific or general Educational Age to his Chronological Age by dividing the former by the latter. The resultant Educational Quotient (E.Q.) indicates whether he is doing better or poorer work than the average child of his own age, and suggests at least to what extent he is above or below what might normally be expected of him. Various subject quotients may be differentiated, such as R.Q. for Reading, Ar.Q. for Arithmetic, and the like.

An attempt has been made to relate achievement tests to intelligence tests directly by a comparison of the Intelligence Quotient with the Educational Quotient in general or the subject quotients in particular. The Accomplishment

Quotient (A.Q.) is found by dividing the E.Q., R.Q., Ar.Q., or other index of achievement, by the I.Q. A simpler procedure is to divide the E.A. by the M.A., which gives the same result. This figure indicates whether the particular pupil is doing as well as might normally be expected for one of his mental ability. Although the concept upon which the measure is based is theoretically a useful one, the resulting computation cannot be taken seriously as an absolute measure. Considering the fact that the age or quotient scores of both the intelligence and the achievement tests are merely approximations, it is evident that the A.Q. must be even more inexact.

For practical use in the schoolroom, the procedure for finding a pupil's grade score is more significant. This may be done for any or all subjects. Many standard tests now provide a scale of grade equivalents of point scores. Thus, a class is tested immediately at the beginning of the sixth grade, and the average grade score is found to be 6.3, indicating that the grade as a whole is accelerated approximately three months as compared with the norm 6.0. One pupil in the class is noted as having a grade score of 4.5, which indicates that he is doing a grade of work which might normally be expected at the middle of the fourth grade. In other words, he is one and one-half years retarded in his achievement in the subject or subjects. The number following the point indicates the month of the school year.

Another common method of revealing test data is by the use of percentile rank or score (see pp. 320-322). If the average point score of a class in a certain test is located on the scale of norms as standing at the percentile rank of 35, it is interpreted as follows: only 35 per cent of the norm group fell below a corresponding score; or 65 per cent of the average pupils, used as a normal type, fell above this score. The median average percentile rank is 50 (see p. 329).

Many use the new-type tests but are in a quandary as to how to treat the point scores which result. Some make the mistake of organizing the test so as to yield 100 points, then taking the per-cent score which each child makes as his actual grade. As a matter of fact, one test may be very easy for the pupils, and another may be relatively difficult. A pupil may attain a per-cent score of 98 on one test and 78 on another but in both cases be deserving of the same high score in terms of actual effort and achievement. Many pupils may receive a score below a passing mark of 60 without actually having done a failing grade of work. All the members of a class may make a score better than 60 on the easier test, yet a number of them may be deserving of failure.

The chief value of the new-type test is to be found in its differentiation of the pupils in a group, especially in the way of diagnosis. Its use for arriving at final monthly or term marks may be questioned. However, if this is desired, it is necessary to use a relative, rather than an absolute, grading system. Some compute the percentile rank of each child; then, following the plan of the normal curve, allot grades as determined by a previously accepted plan. For example, the upper 7 per cent, or those with percentile scores of 93 or over, receive a grade of A; the next lower 24 per cent, having percentile scores between 69 and 93, are given a grade of B; the middle 38 per cent of the group are graded C; and the two lower groups, of 24 per cent and 7 per cent respectively, are graded D and F—the F standing for failure. A better plan, and one which is much simpler, is to make a linear classifier table (see p. 317), then locate the average point score of the class at the middle of the interval covered by the average grade, such as C, which is to be assigned. The scale of grades used is now planned, letting an approximately equal number of point units fall in each step of the scale. Some judgment will need to be

used in deciding from an examination of the papers if the pupil having the best paper is deserving of a high A, a low A, or a B grade; but in general the distribution of grades will be found to be well spread over the scale. The plan does not assume that the normal curve distribution fits every grading situation — a very doubtful assumption indeed — but does provide for a definite scaling of values.

Complicated techniques for treating test data have been evolved, such as standard deviation scores, T-scores, and the like; but however valuable these may be in the hands of the expert or the research worker, they offer too many difficulties for use in the typical classroom.

SPECIAL VALUES AND LIMITATIONS

There is a general tendency to take the results of survey tests too seriously and to interpret these results without due regard to all the factors in the situation. Because these tests can supply little better than mere approximations of pupils' work and their progress in school, they should not be used as the sole means of estimating the quality of instruction. The resultant scores may be regarded as symptomatic of the situation or condition; but unless these are supported by other strong evidence, they should not become the basis of action.

In the earlier days of the testing movement the work of teachers was often unjustly criticized by their superiors who were guided solely by the results of a single test. As a result, many teachers came to regard tests and testing with an unfriendly attitude. This attitude was changed as standard tests came gradually to fulfill their true function as instruments of correct guidance of teacher and pupil. More and more they are being used constructively as one element in a program of diagnostic procedure.

Teachers are yet too frequently depressed if their classes are found to be even slightly below the norm as measured by a standard test, or are over-impressed if the class is given a score which is barely superior to the norm. As a matter of fact, small differences in such measures are seldom significant. The crudity in the instruments of measure used, slight discrepancies in the method of administration, differences in place and time of testing, as well as distractive elements and variations in the moods and attitudes of pupils, would sufficiently explain the superiority or inferiority of scores found. Teachers sometimes also consider the pupil score which is below the norm as absolutely indicative of poor achievement in the subject. Too many chance elements enter into the situation to warrant such a conclusion. As a rule, the high score which a pupil makes is a fairly certain indication of mastery, unless the test itself is not valid in the local situation. But on the other hand a low score, in itself, is not a sure index of deficiency. Other factors may have produced the low score. Conflicting evidence of a sound nature cannot be disregarded, and, in fact, the test results cannot be regarded as final unless they are substantiated by other convincing evidence.

With these cautions in mind, standard achievement tests may be used in a program and plan of classification of pupils. The classification is one based on actual achievement rather than on general mental ability, as is the case when intelligence tests are used. The plan has the advantage of placing the pupils of a certain level of actual progress together, so that they may be more effectively guided than is the case when the groups are mixed. Flexibility in the grouping plan is essential. As children master their weak points in the field of study they may be changed to a higher group, even as those in the advanced group who do poor work or have special difficulties may be put into a

used in deciding from an examination of the papers if the pupil having the best paper is deserving of a high A, a low A, or a B grade; but in general the distribution of grades will be found to be well spread over the scale. The plan does not assume that the normal curve distribution fits every grading situation — a very doubtful assumption indeed — but does provide for a definite scaling of values.

Complicated techniques for treating test data have been evolved, such as standard deviation scores, T-scores, and the like; but however valuable these may be in the hands of the expert or the research worker, they offer too many difficulties for use in the typical classroom.

SPECIAL VALUES AND LIMITATIONS

There is a general tendency to take the results of survey tests too seriously and to interpret these results without due regard to all the factors in the situation. Because these tests can supply little better than mere approximations of pupils' work and their progress in school, they should not be used as the sole means of estimating the quality of instruction. The resultant scores may be regarded as symptomatic of the situation or condition; but unless these are supported by other strong evidence, they should not become the basis of action.

In the earlier days of the testing movement the work of teachers was often unjustly criticized by their superiors who were guided solely by the results of a single test. As a result, many teachers came to regard tests and testing with an unfriendly attitude. This attitude was changed as standard tests came gradually to fulfill their true function as instruments of correct guidance of teacher and pupil. More and more they are being used constructively as one element in a program of diagnostic procedure.

Teachers are yet too frequently depressed if their classes are found to be even slightly below the norm as measured by a standard test, or are over-impressed if the class is given a score which is barely superior to the norm. As a matter of fact, small differences in such measures are seldom significant. The crudity in the instruments of measure used, slight discrepancies in the method of administration, differences in place and time of testing, as well as distractive elements and variations in the moods and attitudes of pupils, would sufficiently explain the superiority or inferiority of scores found. Teachers sometimes also consider the pupil score which is below the norm as absolutely indicative of poor achievement in the subject. Too many chance elements enter into the situation to warrant such a conclusion. As a rule, the high score which a pupil makes is a fairly certain indication of mastery, unless the test itself is not valid in the local situation. But on the other hand a low score, in itself, is not a sure index of deficiency. Other factors may have produced the low score. Conflicting evidence of a sound nature cannot be disregarded, and, in fact, the test results cannot be regarded as final unless they are substantiated by other convincing evidence.

With these cautions in mind, standard achievement tests may be used in a program and plan of classification of pupils. The classification is one based on actual achievement rather than on general mental ability, as is the case when intelligence tests are used. The plan has the advantage of placing the pupils of a certain level of actual progress together, so that they may be more effectively guided than is the case when the groups are mixed. Flexibility in the grouping plan is essential. As children master their weak points in the field of study they may be changed to a higher group, even as those in the advanced group who do poor work or have special difficulties may be put into a

lower group. If a pupil is far above the average in his mastery of one subject but is low in one or more other subjects, he may be placed in the low group until he overcomes his deficiencies in these subjects. When it is administratively possible, it is advisable to group by subjects rather than by grades as a whole.

One of the most effective plans of grouping pupils is that which results from a diagnostic analysis of test papers. Even the general survey tests are susceptible to such treatment, but the diagnostic tests are preferable. The new-type tests, constructed by the teacher, are invaluable aids. As yet there is a scarcity of testing materials which deal with the minutiae of details in any subject. After a thorough analysis of the individual records has been made, as in the plan suggested (p. 295), the pupils are grouped according to specific needs of each, and remedial instruction is undertaken with a view to overcoming the specific deficiencies which are found. The pupils are made fully aware of the goals which are sought and of what they must do to master their difficulties. The plan provides for the changing of pupils from group to group as their particular difficulties are met.

The use of achievement tests may be made the basis of a comprehensive plan of teacher training, especially training in service. Furthermore, they may be an aid to the school supervisor in directing emphasis, and may also throw light on the need for reconstructing or revising the course of study. Comparisons of results are always a source of motivation to the individual pupils, classes, grades, schools, and school systems. The systematic and intelligent use of standard tests should lessen the extreme amount of overlapping in the grades and provide for a more even progress of pupils according to ability. This is especially true when these tests are supplemented by information derived from intelligence tests.

PRACTICAL CONSIDERATIONS

The teacher or other educator who would use achievement tests is in need of special training in their use. The method of administration needs special emphasis. Such routine matters as the passing of papers, supplying of pencils and erasers, and securing thorough attention require practice. One who gives a test should have a thorough mastery of the directions so that they may be given verbatim without reading from the manual. In timed tests, the starting of the entire class on the test and stopping all instantly are matters of importance, as is also the technique of recording time. Without special instruction, one may give the directions too slowly, too rapidly, or without adequate emphasis.

The scoring of standard tests, objective as they are, is often subject to a good deal of error when done by those without experience or training. Much of this is attributable to carelessness. Similarly, errors in transmuting points into other score values, such as educational ages, are numerous. Rigid training will reveal to the user of the tests his specific points of weakness and put him on his guard against committing these errors. Scales which are more or less subjective, such as those in handwriting quality and composition, require a special training of those who would use them. Those who score should practice with model material under the guidance of an expert until their standard closely approaches that of the norm given and until their ratings are found to be highly reliable as compared with the ratings of experts in the field or with their own later ratings of the same papers.

One of the greatest general weaknesses of those who employ tests in the school is found in their inadequate interpretations of results. A thorough knowledge of the

techniques recommended by the test-maker and an understanding of the significance of the resulting data can be assured only by systematic study. Many tests are administered and scored, but there is generally too little in the way of fruitful outcomes, because test data are not systematically analyzed and the findings are not correctly applied.

There is a growing tendency toward letting the pupils participate more fully in the marking of papers, and especially in recording their own scores and comparing their successive scores on these tests. The testing program is thus used as a project in securing the enthusiastic coöperation of pupils in an effort to improve their work. Teachers formerly gave tests to their pupils; now the pupils are given the opportunity to take the tests. If the pupil keeps a graphic record of his progress, he may be motivated to put forth greater effort, not only to do better work himself but also to raise the average of the class.

No test norm is to be regarded as a maximum goal of achievement. In some cases both teacher and class are satisfied if the norm is reached. This is evidence that the function of the norm is not well understood. There should be no relaxation of effort as long as there is one child who does not have an adequate mastery of the subject. In the concern for the group taken as a whole, the teacher may lose sight of that which should be the chief concern—the needs of the individual. Only by directing attention properly to the particular members of the group can real progress be achieved. In the effort to bring the backward pupils up to the norm, the needs of the more capable pupils for an enriched program and specific guidance unfortunately may be neglected.

QUESTIONS AND EXERCISES

Copy and complete the following statements:

1. Another name for educational test is ----- test.
2. Influences which fostered the development of educational tests were
 - a. -----
 - b. -----
 - c. -----
 - d. -----
3. The four forms of test which are most commonly used are
 - a. -----
 - b. -----
 - c. -----
 - d. -----
4. A test battery is one which is made up of ----- Its purpose is to secure an estimate of the -----.
5. An omnibus test is one which is composed of
 - a. -----
 - b. -----

Copy the following complete statements. Under each you will find four possible completions and a blank. Place a check on the short line before any one or more of the completions which you believe correct. If none of them is correct, place the correct completion on the blank line:

1. The prognostic test is one which seeks to
 - a. discover the points of special weakness in a certain field of study.
 - b. find a person's general mental ability.
 - c. discover the level of educational progress which one has reached.
 - d. find the elements of past training which cause present deficiency.
 - e. -----

2. The "new-type" test is one which should be like the standardized test

- a. in the accuracy of its norms.
- b. in the plan for objective scoring.
- c. in the use of equivalent forms.
- d. in the basic content of material tested.
- e. -----

3. The essay-type test is one which

- a. is outmoded and should never be used.
- b. gives a better index to certain characteristics than the objective test.
- c. cannot be scored as accurately as the objective test.
- d. should be used because people generally prefer it.
- e. -----

4. If a standard test reveals a relatively low mark for a pupil and this mark does not correspond with the teacher's general estimates of the achievement of the pupil, he should

- a. conclude that the test is in error.
- b. immediately begin systematic corrective work.
- c. give the pupil other tests.
- d. demote the pupil or place him in a special class.
- e. -----

Copy the following statements. Place a + sign on the short line in front of each of the statements which is true, and on the line following tell why you think it is true. If any are false, indicate this by a - sign before the statement and indicate how it should be corrected on the line following. No grade will be given your answer unless an adequate explanation or correction is given.

--- 1. Intelligence tests and educational tests have the same purpose — that of measuring general mental ability.-----

--- 2. The teacher should always be sure that any test she uses has been properly standardized. -----

--- 3. The teacher's main purpose in using tests should be the guidance of individual pupils. -----

--- 4. The true-false type of test is recommended because of its accuracy in measuring individual performance. -----

--- 5. A test is said to be invalid when its content does not adequately represent the field which the test is supposed to cover. -----

Two lists are here given. Some or all of the first list of ten terms are associated with some or all of the second list of definitions. Place on the short line before any of the items of list one the number of the item in list two which is an adequate definition of the term:

LIST ONE

- | | |
|---------------------------------|-------------------------|
| --- 1. A.Q. | --- 6. Percentile score |
| --- 2. Standard deviation score | --- 7. Grade score |
| --- 3. M.A. | --- 8. E.A. |
| --- 4. E.Q. | --- 9. T-score |
| --- 5. R.A. | --- 10. I.Q. |

LIST TWO

1. An index of the educational status of the pupil as compared with that which might normally be expected from one of his age.
2. An indication of what proportion of the norm group falls below the score made by the pupil or group of pupils.
3. The average variation of the scores made by certain individuals about the general average of the whole group.
4. A measure of the actual school level which a pupil has attained in point of his mastery of a subject or subjects.
5. The pupil's placement on an absolute scale of progress, zero representing total ignorance.
6. A measure of the child's level of general mental ability.

7. A measure which indicates the progress which a pupil has made in a particular school subject in terms of maturity.

8. An index of the pupil's attainment as compared with what might be expected from one of his mental ability.

9. A figure which indicates to what degree an individual's mental ability is superior or inferior to that of the normal person of his own age.

10. A measure of general educational maturity.

REFERENCES

- BRUECKNER, LEO J., and MELBY, ERNEST O. *Diagnostic and Remedial Teaching*. Houghton Mifflin Company, Boston, 1931.
- GILLILAND, A. R., and JORDON, R. H. *Educational Measurements and the Classroom Teacher* (Revised). The Century Co., New York, 1931.
- LANG, ALBERT R. *Modern Methods in Written Examinations*. Houghton Mifflin Company, Boston, 1930.
- MADSEN, I. M. *Educational Measurement in the Elementary Grades*. World Book Company, New York, 1930.
- MONROE, WALTER S., DEVOSS, J. C., and KELLY, F. J. *Educational Tests and Measurements*. Houghton Mifflin Company, Boston, 1924.
- ODELL, C. W. *Educational Measurement in High School*. The Century Co., New York, 1930.
- ODELL, C. W. *Traditional Examinations and New Type Tests*. The Century Co., New York, 1929.
- ORLEANS, J. S., and SEALY, G. A. *Objective Tests*. World Book Company, Yonkers, 1928.
- PATERSON, DONALD G. *Preparation and Use of New Type Examinations*. World Book Company, Yonkers, 1929.
- RUCH, G. M. *The Objective or New Type Examination*. Scott, Foresman and Company, Chicago, 1929.
- RUCH, G. M., and STODDARD, G. D. *Tests and Measurements in High School Instruction*. World Book Company, Yonkers, 1927.
- RUSSELL, CHARLES. *Standard Tests*. Ginn and Company, Boston, 1930.
- SYMONDS, P. M. *Measurement in Secondary Education*. The Macmillan Company, New York, 1927.
- TIEGS, ERNEST W. *Tests and Measurements for Teachers*. Houghton Mifflin Company, Boston, 1931.
- WEBB, L. W., and SHOTWELL, ANNA M. *Standard Tests in the Elementary School*. Ray Long and Richard R. Smith, Inc., New York, 1932.

CHAPTER XVI

ELEMENTS OF STATISTICAL METHOD

The scientific study of educational psychology involves the analysis of the behavior of groups of individuals. Statistics provide a means of describing such groups taken as a whole. Granted that data bearing on a certain aspect or aspects of each member of a group are available, one may so analyze and interpret these data as to show the trend of the entire group. This task demands a knowledge of statistical techniques. Few teachers need to be expert statisticians, but all should have a command of some of the basic methods of treating data. A thorough mastery of statistical methods is needed by anyone who plans to conduct scientific investigations, such as testing or experimentation, in the field of educational psychology.

Some of the factual data regarding individuals or groups are qualitative or descriptive. If one were to observe a boy's behavior and thus arrive at a conclusion that he is "shy, uncommunicative, and moody," he would be using the process of description, and dealing with the statistics of *attributes*. Such data are ordinarily treated by assigning to them a more or less exact numerical value, as is done when a grade of Excellent is valued at 95 per cent. However, most facts are expressed in numerical terms. These are called *variables* and are subject to direct treatment by statistical methods. Among such variables are scores made on intelligence tests, expressed in terms of points, mental ages, or quotients; similar scores resulting from the application of standardized subject tests; and ages.

Sets of typical measurements are here given and analyzed in various ways to illustrate simple methods of statistical treatment. Mere arrays of figures mean little and are often very confusing. Tables must be reorganized, and derived tables must be constructed. Various arithmetical computations must be made, resulting in meaningful numerical quantities. Graphic studies make the relations clear to the eye and thus greatly aid the analysis.

CLASSIFIER AND FREQUENCY TABLES

One of the greatest needs is some means of reorganizing mixed measures so that they will stand in numerical order. If the members of a group have been measured and the record for each has been placed on a separate card (bearing also such items as the name, the age, and the grade of the child), the cards themselves may be shifted into any order desired without losing the identity of the measures. Thus they may be reorganized in the order of grade, age, or alphabetical arrangement, or reshifted according to their rank in the particular measure concerned. A card system of records is a very useful device.

If the records of pupils are kept in lists on sheets, some other device of handling is necessary. In the case of comparatively few measures, such as fifteen or less, they may readily be reorganized by inspection and direct transfer; but where there are many measures — even such a number as occurs in the average class — this procedure is wasteful and subject to error, and a *classifier table* is essential. Both the *linear* and the *compact* forms of the classifier table will be explained.

The data of Table II are arranged in alphabetical order. In making a linear classifier table, the first step is to note which is the highest score. This is found to be 20, made by

pupil No. 4. Also note the lowest score (6, made by pupil No. 8). Now arrange all the *possible* scores from 20 down to 6 inclusive in a *scaled* order without any consideration of whether or not they are all represented in the actual list of measures, as is done in the score column of Table III.

TABLE II. SCORES OF PUPILS IN A SPELLING TEST OF TWENTY WORDS

PUPIL			PUPIL			PUPIL		
No.	Name	SCORE	No.	Name	SCORE	No.	Name	SCORE
1	Adams	13	11	Hunt	15	21	Rosen	15
2	Allen	18	12	Lowe	11	22	Rush	14
3	Bishop	17	13	Marsh	15	23	Saam	19
4	Brown	20	14	Matthews	16	24	Soddy	15
5	Burns	9	15	McCune	19	25	Strong	12
6	Cohn	14	16	Mortimer	14	26	Switzer	14
7	Dakin	14	17	Nash	12	27	Terry	15
8	Dewey	6	18	O'Brien	11	28	Walsh	17
9	Forbes	12	19	Overton	9	29	Wise	14
10	Hart	17	20	Page	17	30	Yates	10

TABLE III

SCORE	TALLY	f	SCORE	TALLY	f
20	/	1	12	///	3
19	//	2	11	//	2
18	/	1	10	/	1
17	////	4	9	//	2
16	/	1	8		
15	///	5	7		
14	/// /	6	6	/	1
13	/	1			30

The next step is to note the score of pupil No. 1 in Table II. Locate this score (13) in the first column of Table III, and opposite this score record a tally. Then place a tally opposite the score (18) made by pupil No. 2, and so on down the list until all the measures of Table II have been recorded by tallies in Table III. Do not get the habit

of looking through the original set of scores for the highest mark (20) and then placing a tally opposite this score in Table III, then looking for the next highest score (19), of which there are two cases, and so on. This method is wasteful and subject to error. When the tallying is complete, place in the *f* (frequency) column the number of cases for each score.

When one desires to identify the pupils in the classifier table, the procedure of Table IV is used. In this case the pupils' numbers or initials may be recorded instead of the tally.

TABLE IV

SCORE	PUPIL No.	<i>f</i>	SCORE	PUPIL No.	<i>f</i>
20	4	1	12	9, 17, 25	3
19	15, 23	2	11	12, 18	2
18	2	1	10	30	1
17	3, 10, 20, 28	4	9	5, 19	2
16	14	1	8		
15	11, 13, 21, 24, 27	5	7		
14	6, 7, 16, 22, 26, 29	6	6	8	
13	1	1			$\frac{1}{30}$

It can be seen at a glance or by reference to the alphabetical list that Brown, McCune, Saam, and Allen are the four having the highest scores, and that Dewey, Burns, Overton, and Yates have the four lowest scores.

If there is a wide range of units between the highest and lowest measures, it is sometimes best to use a compact form of classifier table in which the units from 0 through 9 are indicated in the columns, and the tens and hundreds in the various rows. The examination grades of a group of pupils are as follows:

<i>Pupil:</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
<i>Grade:</i>	74	76	85	59	84	73	72	92	80	81	75	74	86	82	65	62	79	76
<i>Pupil:</i>	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34		
<i>Grade:</i>	55	92	67	69	73	66	81	100	77	94	81	74	81	86	92	94		

TABLE V. COMPACT CLASSIFIER TABLE

TENS	UNITS										f
	0	1	2	3	4	5	6	7	8	9	
10	/										1
9			///		//						5
8	/	////	/		/	/	//				10
7			/	//	///	/	//	/		/	11
6			/			/	/			/	5
5						/				/	2
N 34											

The highest grade is noted as 100 and the lowest as 55. The plan of Table V is laid out so as to include all intermediate grades. The grade of 74, made by pupil No. 1, is noted, and a tally is recorded in the square common to row 7 and to column 4. The grade (76) for pupil No. 2 is next indicated by tally, and so on for all 34 grades in order. A frequency column is added for the purpose of summing the number of cases in each row and adding these to check the total number of cases (N).

RANKING OF MEASURES

With the measures arranged in numerical order according to the plan of the classifier table, it is possible to give each member a rank value. There are two types of ranks, each having its particular function.

Ordinary place rank. In this, the simplest type of ranking procedure, high rank is indicated by the figure 1. There are as many ranks as there are cases. In Table VI are given the ranks of the pupils in Table III. The pupil who made a score of 20 receives the rank of 1. There are two pupils who have a score of 19, and these take up ranks 2 and 3. Since both have the same score, they must receive the same rank. It

would be illogical to give both the rank of 2 or of 3; therefore a compromise is made by giving each one a rank of $2\frac{1}{2}$, or the middle rank. One child makes a score of 18, and since ranks 1, 2, and 3 are used up, he receives a rank of 4. There are four with a score of 17 who are competing for ranks 5, 6, 7, and 8, and these are given the middle rank of $6\frac{1}{2}$. If there had been two cases with a score of 20, the highest rank would have been $1\frac{1}{2}$; if there had been three with a score of 6, the lowest rank would have been 29.

TABLE VI. ORDINARY PLACE RANK

SCORE	<i>f</i>	RANK	SCORE	<i>f</i>	RANK
20	1	1	12	3	23
19	2	$2\frac{1}{2}$	11	2	$25\frac{1}{2}$
18	1	4	10	1	27
17	4	$6\frac{1}{2}$	9	2	$28\frac{1}{2}$
16	1	9	8		
15	5	12	7		
14	6	$17\frac{1}{2}$	6	1	30
13	1	21			

Percentile rank. It is evident that a rank value of 10 would be meaningless unless the size of the group were known. If there were only ten cases, this rank would be the lowest; if there were fifty, it would be near the top. In a typical classroom group, the number of pupils often changes greatly in the course of a year; therefore it is desirable to think of rank in terms of the relative rank which each pupil would have in case there were 100 pupils in the class with the same proportionate distribution of cases: from another point of view, what percentage of the group exceeds or falls below the standing of the particular pupil. Contrary to the ranking in Table VI, the pupil with the highest score will here receive the highest rank value (indicating a near approach to 100), and the pupil with the

smallest score will approach a rank of 0. The rank of 10 is called the tenth percentile or first decile and means that 10 per cent of the class rank lower and 90 per cent rank higher than the pupil who receives this score. The rank value has now a very general meaning, rather than a merely local one.

In Table VI there are thirty cases. Each case will have a rank value of $\frac{100}{30}$, or 3.33, as there are 30 cases to be distributed over the 100-scale spaces from 0 to 100. The percentile rank may be thought of as located at the middle of the individual measure, in contrast to ordinary place rank, which is placed at the upper limit.

TABLE VII. TWO METHODS OF FINDING PERCENTILE RANK

SCORE	<i>f</i>	R	$R - \frac{1}{2}$	P.R.	<i>f_c</i>	<i>p_{ul}</i>	P.R.
20	1	30	$29\frac{1}{2}$	98.3	30	100.0	98.3
19	2	$28\frac{1}{2}$	28	93.3	29	96.7	93.3
18	1	27	$26\frac{1}{2}$	88.3	27	90.0	88.3
17	4	$24\frac{1}{2}$	24	80.0	26	86.7	80.0
16	1	22	$21\frac{1}{2}$	71.7	22	73.3	71.7
15	5	19	$18\frac{1}{2}$	61.7	21	70.0	61.7
14	6	$13\frac{1}{2}$	13	43.3	16	53.3	43.3
13	1	10	$9\frac{1}{2}$	31.7	10	33.3	31.7
12	3	8	$7\frac{1}{2}$	25.0	9	30.0	25.0
11	2	$5\frac{1}{2}$	5	16.7	6	20.0	16.7
10	1	4	$3\frac{1}{2}$	11.7	4	13.3	11.7
9	2	$2\frac{1}{2}$	2	6.7	3	10.0	6.7
8					1	3.3	3.3
7					1	3.3	3.3
6	1	1	$\frac{1}{2}$	1.7	1	3.3	1.7

One method of finding percentile rank is first to rank the scores from the bottom up by the ordinary place rank method as shown in the R column of Table VII. Now plan another column, $R - \frac{1}{2}$, in which each of these rank values is lowered by half a rank. The percentile rank (P.R.) of each or any score is now found by multiplying this $R - \frac{1}{2}$ value by the rank value, $3\frac{1}{3}$.

Another method of arriving at the same end is also indicated in the last three columns of Table VII. The first step is to make a cumulative frequency (f_c) column. This shows how many cases there are up to and including any measure. For example, there are 21 cases falling below 16 or up through 15. Now multiply each of these amounts by the reciprocal value of $3\frac{1}{3}$, yielding the numbers given in the p_{ul} column, which are the percentile values of the upper limit of the measure (identical with the lower limit of the next measure above). In this case, if 16 be considered a mid-point value of the unit measure extending from 15.5 to 16.5, there are 70 per cent of the measures falling below 15.5. The percentile rank is now found by averaging the adjacent p_{ul} values. For the measure in question (15), the P.R. is one half the sum of 70 and 53.3, or 61.7. To obtain the P.R. of the lowest measure, one must note that the p_{ul} value of the next lower measure in the scale (in this case, 5) would be 0.

GROUPING OF MEASURES

In many cases it is advisable to group the measures. This means that the measures are not treated as simple units but are combined into *class intervals*. For example, the five measures from 20 through 24 may be united in one interval, being spoken of as a five-unit interval. Grouping is used for one or more of the following reasons: to compare data with other data similarly grouped; to make the data more compact; to simplify and facilitate the handling of, and computations for, large amounts of data; to make the scale coarser, so as to show the trend of the distribution of cases better and to remove irregularities in the distribution; to give an indication of what the distribution would be like if the number of cases were increased.

In view of the fact that computations are less accurate when made from grouped data than from ungrouped data, grouping is not recommended for less than forty or fifty cases, as a general rule, or for less than about one hundred cases if high accuracy is desired. The larger the number of cases, the more the errors tend to be neutralized.

In recording the intervals, it is better to make them mutually exclusive. Thus adjacent intervals should be given in the form 20-24, 25-29, rather than 20-25, 25-30. The interval 20.0-24.9 is interpreted as including the measures from 20 *through* 24, or to 25. If the unit measure were to be considered the mid-point of the measure, then the interval in this case would be 19.5-24.4⁺. The mid-point of an interval is halfway between its lower limit and that of the interval above.

TABLE VIII. GROUPED FREQUENCY TABLE

CLASS INTERVAL	MID-POINT	TALLY	<i>f</i>
19.50-21.49	20.5	/	1
17.50-19.49	18.5	///	3
15.50-17.49	16.5	////	5
13.50-15.49	14.5	//// //	11
11.50-13.49	12.5	////	4
9.50-11.49	10.5	///	3
7.50-9.49	8.5	//	2
5.50-7.49	6.5	/	1

N = 30

In Table VIII the scores of Table II have been grouped in intervals of two units for purposes of illustration. In constructing such a table from original data, one first records the intervals in order and indicates mid-points if he desires. He then notes the score made by pupil No. 1 (in this case, 13) and places a tally opposite the interval containing the score. He next makes a tally following the interval containing the score of pupil No. 2, and so on as was done in

the case of the classifier table. One may check the accuracy of his work by reference to a classifier table, or may even form the grouped frequency table directly from the classifier table. Identification may be used instead of tally with this table as with the classifier table.

The grouping of these data, it may be noted, has given a more compact table with a coarser scale and has resulted in a smoother approach to a high frequency in the center than was the case with the classifier table (Table III).

The greater the number of cases, the greater the number of intervals that may be allowed. One ordinarily avoids using such a large number as to make the table too cumbersome and also avoids the use of a very coarse scale. Grouping by 10's is usually the practice because of the simplicity which this gives in making computations, but one should not be a slave to this size of interval to the neglect of other considerations. For example, in dealing with ages in months, or height in inches, intervals of 12 or 6 are naturally suggested, with significant figures such as 120 months or 60 inches standing at the mid-points of their respective intervals. Ordinary place rank or percentile rank may be computed for grouped frequency tables by following the same rules as were given in connection with the classifier table.

FREQUENCY GRAPHS

The data of Table VIII become much more vivid when presented in the form of a diagram. One of the surface-of-frequency type of graphs is the histogram shown in Fig. 11. The horizontal scale is laid off in terms of class intervals from low at the left to high at the right. On the vertical scale the frequency is indicated. The frequency for any interval is noted, and a column for this interval is erected to the height of this frequency as determined by the vertical scale.

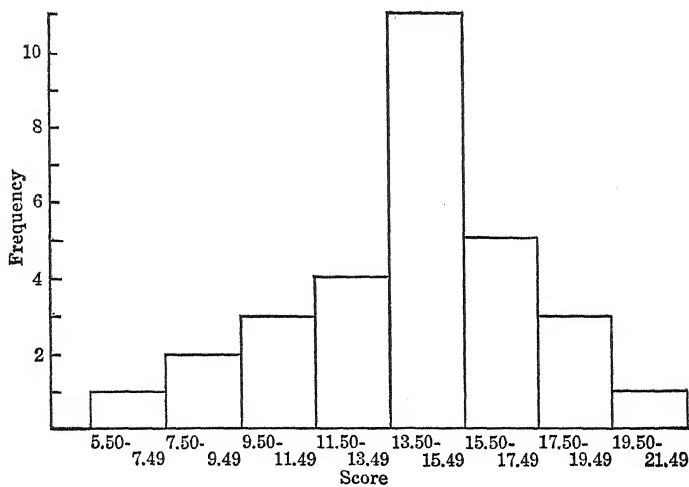


FIG. 11. Histogram of frequency

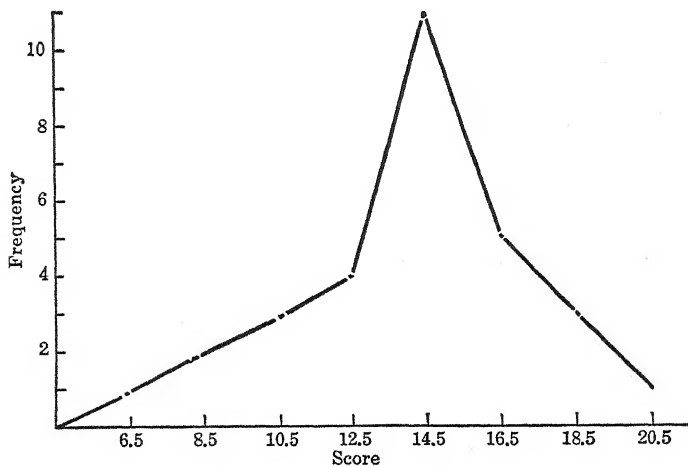


FIG. 12. Frequency polygon

The same data are represented by a frequency polygon in Fig. 12, in which straight-line segments connect the points representing the number of cases for each interval. The mid-point of the class interval is here given on the base line, since it is assumed that the measures within an interval fall at the mid-point of the interval.

Another form of the frequency graph is that which deals with the cumulative frequency. One of this type is the *ogive*, which tells how many cases fall below any point on the scale. The total frequency is indicated on one scale, and the lower limits of the intervals on the other scale. Referring to Table VII and keeping the interpretation of the unit measure given on page 322, one notes that there are no cases up to 5.5. One case falls below 6.5, as is true also for 7.5 and 8.5, but there are 3 cases accumulated up to 9.5. One places a dot at the junction of 0 frequency and the score value of 5.5, another at the frequency of 1 and the score 6.5 and so on, the last dot falling at the junction of the f_c of 30 and score value of 20.5. These dots are then connected with straight lines to complete the ogive.

A special type of ogive which is in common use and which should be well understood is termed the *percentile curve*. This is illustrated in Fig. 13, which is based on the data of Table VII. Here the cumulative frequency is given in terms of 100, and the p_u values are graphed at the lower limit of the next higher interval. Percentile curves are valuable as a means of portraying the percentage of the cases that fall below any given measure, as well as noting the measure below which any given per cent of the cases fall. When accurately made to a fine scale, computations of decile and percentile values may be made direct from the reading of the graph, either as a substitute for mathematical procedures or as a check on such computations.

The graphic comparison of two or more frequency dis-

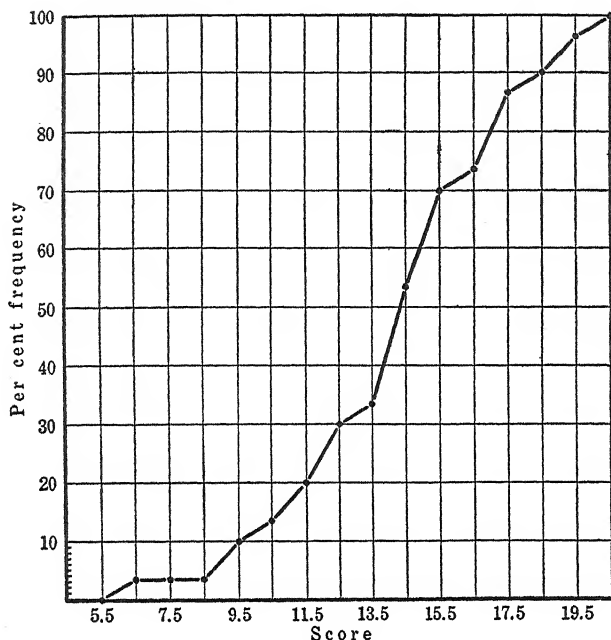


FIG. 13. Percentile Curve

tributions having the same class intervals may be made by the use of polygons or ogives on the same base scale, but with lines differentiated. In comparing groups of different sizes the polygons may be better presented as graphs of the percentage of frequency falling in each interval, and the comparison is more effective when made with percentile curves than is the case with ordinary ogives. Histograms may be used for this purpose; but to avoid confusion of lines, they should be placed one above the other on different frequency scales, but with the same class intervals placed in the same position on the base scale. The overlapping of grades is well shown by this procedure.

MEASURES OF CENTRAL TENDENCY, OR AVERAGES

A definite measure is needed that will express the standing of the group taken as a whole. Some individual measures are comparatively high and some are comparatively low; it is desirable when all cases are taken into consideration to know what measure they tend to follow. This measure is especially valuable in education in noting the particular ability of children of a certain age or grade as shown in the results of a certain test, or the increase of ability in a group as a result of certain drills or a certain type of instruction. There are several different kinds of average, of which only three will be noted and briefly described. For comparative values and uses the reader must examine more detailed sources. When one uses an average, he should be careful to indicate which one is used.

The mode. The mode is ordinarily found by mere inspection of a frequency distribution and consists of that measure, or mid-point of a class interval, which occurs the greatest number of times as indicated by the greatest frequency. In Table III, for example, the score 14, which occurs six times, is called the mode (Mo.). In Table VIII the interval 13.50-15.49 has the greatest frequency (11), and since its mid-point is 14.5, this is called the mode. In case two measures or intervals have high frequencies, with one or more low frequencies in intervening measures, the distribution is said to be bimodal. If two adjacent measures have the same high frequency, the mode is considered as lying halfway between the two measures. The mode is to be considered more a descriptive measure than an exact one. It cannot be considered an accurate mathematical term, and is to be taken seriously only when there are many cases grouped on a fine scale. There are methods of finding the mathematical mode, which is a more exact measure.

The median. The standing of the middle case may be regarded as typical of the group. The median (Md.) is the measure which belongs to the middle or median case when the measures are arranged in rank or scaled order. This average cannot be found in a series of measures arranged in mixed order, as in Table II; they must first be reorganized, as in Table III. The middle case of the thirty measures in Table III is halfway between the fifteenth and sixteenth cases, or at the upper limit of the fifteenth case, so that there are fifteen cases above and fifteen below. Count from the bottom up, $1 + 2 + 1 + 2 + 3 + 1 = 10$. The next frequency group added would make sixteen. Since both the fifteenth and the sixteenth cases receive the score of 14, this score is roughly called the median.

A more exact method uses the process of interpolation. Counting up to the interval 13.50-14.49, of which 14 is the mid-point, there are ten cases. But one must count through the fifteenth case to find the median. There are therefore five more cases needed. There are six cases in this interval, and they are assumed to be evenly distributed within it. The median lies at a point on the scale five sixths of the interval of 1 above the lower limit of the interval. $\frac{5}{6}$ of 1 = 0.8. $13.50 + 0.8 = 14.3$, the median.

Performing the same operation in Table VIII, we have $1 + 2 + 3 + 4 = 10$. $15 - 10 = 5$. $\frac{5}{11}$ of 2 = 0.9. $13.5 + 0.9 = 14.4$, the median.

In finding the median no attention is given to the place on the scale occupied by the measures on either side of the central tendency, whether these are scattered or condensed or whether there are extremely large or small measures among them. This is not the case with the next measure to be considered.

The mean. The mean is the measure of central tendency commonly known as the *average*. It should be spoken of as

the *mean average*. The members of a group make a series of scores as in Table II. If they had made the same grand total in scores, but all their records had been the same, the score made by each would be the mean average. All measures are added together and divided by the number of cases. The mean may be thought of as the fulcrum on which the scale rests so that the measures above and below, acting as weights, maintain a perfect balance. It is evident that the score which is twice as far from the mean as another score has twice the "pull" on that end of the scale.

TABLE IX

SCORE	DEVIATION		SCORE	DEVIATION		SCORE	DEVIATION	
	-	+		-	+		-	+
13	2		15	0	0	15	0	0
18		3	11	4		14	1	
17		2	15	0	0	19		4
20		.5	16		1	15	0	0
9	6		19		4	12	3	
14	1		14	1		14	1	
14	1		12	3		15	0	0
6	9		11	4		17		2
12	3		9	6		14	1	
17		2	17		2	10	5	
<i>Total</i>							51	25

In computing the mean of an ungrouped series the scores may be dealt with in any order. In Table II the sum of the measures is 424. This sum, divided by 30, equals 14.13, which is the mean.

Another method of computing the mean which is very useful is first to *assume* a mean. With reference to the data of Table II, let us assume a mean of 15. Now record, as in Table IX, how much each score is less than (-) or greater than (+) the assumed mean of 15. Adding the minus column, we get 51; and adding the plus column, we get 25.

If the assumed mean had been correct, the minus and plus amounts would exactly balance each other. But it is evident that the mean has been assumed too high, since there are 26 more units in the minus column than there are in the plus column. This amount is distributed through all 30 cases. Therefore, a correction (*c*) must be made by averaging this, or dividing -26 by 30 . This correction is found to be $-.87$. When this correction is added algebraically to the assumed mean of 15 , the true mean, 14.13 , is found.

TABLE X. TWO METHODS OF FINDING MEAN FROM GROUPED DATA

CLASS INTERVAL	<i>m</i>	<i>f</i>	<i>fm</i>	<i>d'</i>	<i>fd'</i>
19.50-21.49	20.5	1	20.5	3	3
17.50-19.49	18.5	3	55.5	2	6
15.50-17.49	16.5	5	82.5	1	5
13.50-15.49	14.5	11	159.5	0	0
11.50-13.49	12.5	4	50.0	-1	-4
9.50-11.49	10.5	3	31.5	-2	-6
7.50- 9.49	8.5	2	17.0	-3	-6
5.50- 7.49	6.5	1	6.5	-4	-4
		30	423.0		-20
					-6

$$Mn = \text{Assumed mean} + \frac{(\text{sum of } fd')h}{N}$$

$$14.5 + \left(\frac{-6 \times 2}{30} \right)$$

$$14.5 - .4 = 14.1$$

In Table VIII, with grouped data, the ordinary procedure is as follows. Let the mid-point of each class interval represent the measure (*m*), or value, of the interval. Table X shows this *m* column. There is now one case receiving a measure of 20.5, three cases each receiving a measure of 18.5, or a total (*fm*) of 55.5, and so on. The total of the *fm* column is found to be 423, and this sum represents the total scores made by all thirty subjects. The mean for the group then is 423 divided by 30, or 14.1.

The short method of finding the mean with grouped data is also shown in Table X. Here the mid-point of one of the intervals is chosen as the assumed mean. In this case, 14.5 was taken, but any other of the m values would have served as well. The deviation of each of the mid-points above and below the one assumed as a mean is next placed in the d' column. These are given in terms of intervals, and those below are indicated by a minus sign. Next, the deviations are multiplied by the frequencies, keeping signs, and the product is placed in the fd' column. This column is then added algebraically, and the sum is multiplied by the number of units in the interval (h), in this case 2. The product is then divided by the number of cases, to find the correction which must be made to the assumed mean in order to find the true mean. If the sign is *minus*, subtract the quantity from the assumed mean; if the sign is *plus*, add it to the assumed mean. The formula and work are given in organized form directly below Table X. The short method simplifies the work of computation greatly and makes for greater accuracy, especially with large distributions. Note that in all cases where an assumed average is taken, a correction must be made.

MEASURES OF DEVIATION

The measures of central tendency of a group do not tell the whole story regarding the measures themselves. We wish to know something of how nearly alike the members of the group are. Two groups might have the same average, yet differ widely in the way their members cluster around this average, one being very homogeneous with a comparatively small scattering of measures above and below the average, and the other having a number of very high and very low measures. The latter would have a larger deviation.

Quartile deviation. This is a very easily understood deviation measure, being half the spread on the scale of the middle 50 per cent of the group. It is found by counting up in the cases and locating the point of the scale below which 25 per cent of the cases fall (Q_1), then counting down from the top and locating the point (Q_3) below which 75 per cent of the cases fall. Q_1 is then subtracted from Q_3 to give the spread of the middle 50 per cent of the cases, and the remainder is divided by 2 to give the quartile deviation (Q.D. or Q.). The procedure for finding the quartile points Q_1 and Q_3 is the same as that used in finding the median.

Referring to Table VIII, $\frac{1}{4}$ of 30 = 7.5. Counting up, $1 + 2 + 3 = 6$. $7.5 - 6 = 1.5$. $1.5/4 = \frac{3}{8}$. $\frac{3}{8}$ of 2 = 0.75. $11.50 + 0.75 = 12.25(Q_1)$. Counting down, $1 + 3 = 4$. $7.5 - 4 = 3.5$. $3.5/5 = \frac{7}{10}$. $\frac{7}{10}$ of 2 = 1.4. $17.50 - 1.4 = 16.1(Q_3)$. $16.10 - 12.25 = 3.85$. $3.85/2 = 1.925$, or 1.9, which is the quartile deviation.

Standard deviation. This is a more complex measure, but an increasingly common one. It is represented by the symbol S.D., or σ , and is also called the root-mean-square deviation. In case the distribution is a close approach to the normal curve, it represents approximately half the spread of the middle two thirds of the group. The long method with ungrouped data is, first, to find the deviation of each measure from the mean average; secondly, to square each of these deviations; and then to add these squares and divide by the number of cases to find the mean of the squares of the deviations. The standard deviation is the square root of this average. Applying this procedure to Table II, we note that the mean to one decimal place is 14.1. The deviations are found without regard to sign, as the squaring process removes the minus sign. The sum of the squares of the deviations is 307.50. This sum, divided

by 30, is 10.25, and the square root of this quotient gives 3.2 as the standard deviation. By the short process, one assumes a mean, finds the deviation of each measure from this assumed mean, keeping signs, squares each of the deviations, and divides the sum of these squared values by the number of cases. He then corrects this quotient by subtracting from it the square of the quotient obtained by dividing the algebraic sum of the deviations by the number of cases. The square root of the remainder is the standard deviation, and should agree with that obtained by the long method. Quantities under the radical should be carried to four decimals if one wishes to secure a computation correct to the nearest single decimal.

With grouped data, the short process alone is recommended because of its greater simplicity and accuracy. Here a mean is assumed, as was done in finding the mean (Table X) by the short method. Using the data of Table X, an additional column, entitled fd^2 , must be planned, the items of which are obtained by multiplying each fd' value by its corresponding d' value: $3 \times 3 = 9$, $6 \times 2 = 12$, $5 \times 1 = 5$, $0 \times 0 = 0$, $-4 \times -1 = 4$, and so on. When these products are added, they total 76. This sum is next divided by the number of cases (30), to yield 2.5333. From this quotient the square of the correction (algebraic sum of the fd' 's divided by the number of cases, 30), or .04, is subtracted, giving a remainder of 2.4933. The square root of this figure gives 1.58, which is the standard deviation expressed in terms of intervals. Since there are two units to the interval, the figure 1.58 must be multiplied by 2 to give the standard deviation, 3.16. Like most other statistical computations, this figure is of little significance when standing alone. Only through comparison of S.D.'s can they be meaningful, for only then is one group shown to be more or less homogeneous than another.

CORRELATION

A special phase of applied statistics has to do with the relations between two sets of measures of the same group. It is possible to compare the two sets as to distribution, averages, or deviations, but these measures tell us nothing as to whether or not there is an essential agreement of the individual measures. Do the individuals who are high or low in the one set stand correspondingly high or low in the second set? If so, there is said to be a high *positive* correlation. If those who are high in one set are low in another, and vice versa, the correlation is considered as a high *negative* one. If no relationship can be discovered between the pairs of measures in these respects, no correlation, or approximately zero correlation, is indicated.

The most common measure of correlation is called the coefficient of correlation (r). This is a ratio which may be expressed from $+1$, indicating perfect *positive* correlation, down through all the intervening decimal fractions to -1 , indicating perfect *negative* correlation. The nearer the decimal approaches .00 the smaller the degree of correlation. From the standpoint of accuracy of prediction, the r of

.90 to 1.00 is very high
.80 to .90 is high
.60 to .80 is marked
.40 to .60 is low
0 to .40 is very low

There are numerous methods of computing the r , each having its particular advantages as regards reliability, accuracy, or speed. Only two of the most common will be noted here.

Spearman rank method. When from twenty-five to thirty-five cases are being dealt with, the rank method is a

sufficiently accurate one unless very precise results are demanded. The formula for solution is $\rho = 1 - \frac{6 \sum D^2}{N(N^2 - 1)}$, in which $\sum D^2$ equals the sum of the squares of the differences in ranks of the respective pairs of measures, N equals the number of cases, and ρ equals a close approximation to r , which need not be corrected except where greater accuracy is demanded. The process is shown in columns 4 to 7 of Table XI and the computations directly below, the scores of a class of twenty-five pupils in the two tests A and B being correlated. The ρ of $-.745$ shows a marked negative correlation between the two tests.

Pearson product-moment method. The rank method fails to take into account the actual scale placement of the respective measures. This is cared for by the product-moment method. The procedure is illustrated in columns 8 to 12 in Table XI and the computation given below the table. The short method is here used, involving the assuming of mean averages for each of the tests. The mean assumed for Test A is 12 and for Test B is 16. Any other figure would do as well in either case, but selecting one somewhere near the true mean will give smaller numbers with which to work. Some prefer to assume the mean as equivalent to the lowest number in the series, or even at zero, as this makes all deviation values positive. Note that the deviations (x' for Test A, and y' for Test B) are deviations from the assumed mean and that the signs are carefully kept. The first score (6) is -6 units deviation from the assumed mean of 12, while 20 is 4 units above 16. The squaring of the deviations removes the minus sign. In the $x'y'$ column, the sign yielded by the products is indicated. Care must be taken to find the algebraic sum of the x' , y' , and $x'y'$ columns, and to keep the signs in all computations. The two terms under the radical in the denominator will be

TABLE XI. TWO METHODS OF CORRELATION WITH UNGROUPED DATA

1	2	3	4	5	6	7	8	9	10	11	12
PUPIL No.	SCORE		RANK								
	A	B	A	B	D	D ²	x'	y'	x' ²	y' ²	x'y'
1	6	20	23½	3½	20	400	-6	4	36	16	-24
2	14	11	9½	17½	8	64	2	-5	4	25	-10
3	9	18	21½	5½	16	256	-3	2	9	4	-6
4	3	15	25	12½	12½	156¼	-9	-1	81	1	9
5	11	15	17½	12½	5	25	-1	-1	1	1	1
6	12	24	15½	1	14½	210¼	0	8	0	64	0
7	9	16	21½	9½	12	144	-3	0	9	0	0
8	13	10	13	20	7	49	1	-6	1	36	-6
9	17	9	2	22	20	400	5	-7	25	49	-35
10	15	16	6	9½	3½	12¼	3	0	9	0	0
11	6	22	23½	2	21½	462¼	-6	6	36	36	-36
12	14	8	9½	23	13½	182¼	2	-8	4	64	-16
13	19	5	1	25	24	576	7	-11	49	121	-77
14	11	17	17½	7	10½	110¼	-1	1	1	1	-1
15	13	12	13	15	2	4	1	-4	1	16	-4
16	10	16	19½	9½	10	100	-2	0	4	0	0
17	14	10	9½	20	10½	110¼	2	-6	4	36	-12
18	16	7	3½	24	20½	420¼	4	-9	16	81	-36
19	15	12	6	15	9	81	3	-4	9	16	-12
20	14	12	9½	15	5½	30¼	2	-4	4	16	-8
21	12	20	15½	3½	12	144	0	4	0	16	0
22	10	18	19½	5½	14	196	-2	2	4	4	-4
23	15	10	6	20	14	196	3	-6	9	36	-18
24	13	16	13	9½	3½	12¼	1	0	1	0	0
25	16	11	3½	17½	14	196	4	-5	16	25	-20
Total						4537½	7	-50	333	664	-315

$$\rho = 1 - \frac{6 \sum D^2}{N(N^2 - 1)} = 1 - \frac{6 \times 4537\frac{1}{2}}{25(625 - 1)} = 1 - \frac{27225}{15600} = 1 - 1.745 = -.745$$

$$r = \frac{\frac{\sum x'y'}{N} - \left(\frac{\sum x'}{N} \cdot \frac{\sum y'}{N}\right)}{\sqrt{\frac{\sum x'^2}{N} - \left(\frac{\sum x'}{N}\right)^2} \sqrt{\frac{\sum y'^2}{N} - \left(\frac{\sum y'}{N}\right)^2}} = \frac{\frac{-315}{25} - \left(\frac{7}{25} \cdot \frac{-50}{25}\right)}{\sqrt{\frac{333}{25} - \left(\frac{7}{25}\right)^2} \sqrt{\frac{664}{25} - \left(\frac{-50}{25}\right)^2}}$$

$$= \frac{-12.60 + .56}{\sqrt{13.32 - .08} \sqrt{26.56 - 4.00}} = \frac{-12.04}{3.64 \times 4.75} = \frac{-12.04}{17.29} = -.696$$

recognized as the standard deviations of the two sets of scores, and the last two terms of the numerator as the respective corrections. The coefficient of $-.696$ corresponds fairly closely with that found by the rank method.

If the long method were used with ungrouped data, the actual means and deviations about these means would then be taken to one decimal. The process differs from that given above in the fact that no corrections need be made. One of the following formulæ may be used:

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \cdot \Sigma y^2}} = \frac{\Sigma xy \div N}{\sigma_x \cdot \sigma_y} = \frac{\frac{\Sigma xy}{N}}{\sqrt{\frac{\Sigma x^2}{N}} \sqrt{\frac{\Sigma y^2}{N}}} = \frac{\Sigma xy}{N \sigma_x \sigma_y}.$$

With grouped data, a *correlation table* must be used so as to keep the position of the paired measures. The table and procedures are illustrated in Table XII. Ordinarily one would not group the data with so few cases, especially when the range is so compact, but this is done here merely to serve as a model. The tallies are placed in the table after the scales have been recorded on the x and y axes by following the same plan as with the classifier table; that is, note the pair of scores made by pupil No. 1 and make a tally in the compartment or square common to both scales at the respective intervals in which the measures fall. For example, $A = 6$, $B = 20$ falls at the junction of the intervals 4.5–6.4 on the x scale and 19.5–22.4 on the y scale. When tallies for all pairs have been recorded, check the work carefully by repeating the process, as errors at this point are very common and may be serious in point of the accuracy of the final computation.

The student will recognize the f , d , fd , and fd^2 columns and their totals as the same processes as were used in finding S.D. There is only one new feature, that is, the method

TABLE XII. CORRELATION OF GROUPED DATA

X Scale — Test A

	2.5 —	4.5 —	6.5 —	8.5 —	10.5 —	12.5 —	14.5 —	16.5 —	18.5 —	f_y	d_y	$f_y d_y$	$f_y d_y^2$	Σxy
22.5 —					i — 3					1	3	3	9	— 3
19.5 —		— 16 ii			— 2 i					3	2	6	12	— 18
16.5 —				— 4 ii	— 1 i					3	1	3	3	— 5
13.5 —	i 0			ii 0	i 0	i 0	i 0			6	0	0	0	
10.5 —						0 — 2 iii ii				5	— 1	— 5	5	— 2
7.5 —						0 — 2 iii i	— 4 i			5	— 2	— 10	20	— 6
4.5 —						— 3 i		— 9 i		2	— 3	— 6	18	— 12
f_x	1	2	0	4	4	7	5	1	1	25		— 9	67	— 46
d_x	— 5	— 4	— 3	— 2	— 1	0	1	2	3					
$f_x d_x$	— 5	— 8	0	— 8	— 4	0	5	2	3	— 15				
$f_x d_x^2$	25	32	0	16	4	0	5	4	9	95				

$$r = \frac{\frac{\Sigma xy}{N} - \left(\frac{\Sigma f_x d_x}{N} \times \frac{\Sigma f_y d_y}{N} \right)}{\sqrt{\frac{\Sigma f_x d_x^2}{N} - \left(\frac{\Sigma f_x d_x}{N} \right)^2} \sqrt{\frac{\Sigma f_y d_y^2}{N} - \left(\frac{\Sigma f_y d_y}{N} \right)^2}} = \frac{\frac{-46}{25} - \left(\frac{-15}{25} \times \frac{-9}{25} \right)}{\sqrt{\frac{95}{25} - \left(\frac{-15}{25} \right)^2} \sqrt{\frac{67}{25} - \left(\frac{-9}{25} \right)^2}}$$

$$= \frac{\frac{-1.840}{3.80} - \frac{.216}{.36}}{\sqrt{2.68} - .13} = \frac{\frac{-2.056}{1.85} - \frac{2.056}{1.60}}{2.960} = -.695$$

of finding the product moments. The Σxy is more adequately designated by $\Sigma(f_{xy}d_xd_y)$. In other words, one multiplies the frequency in each compartment by the interval deviation of that square in x and also in y , keeping signs, records these products in the corner of the square, then adds them algebraically to secure the figures in Σxy col-

umn. This column is then added algebraically. The substitution of these values in the formula and the computation of r is then a matter of careful routine. The coefficient of correlation here found agrees quite closely with that found for the ungrouped data. Note that the computation of r is

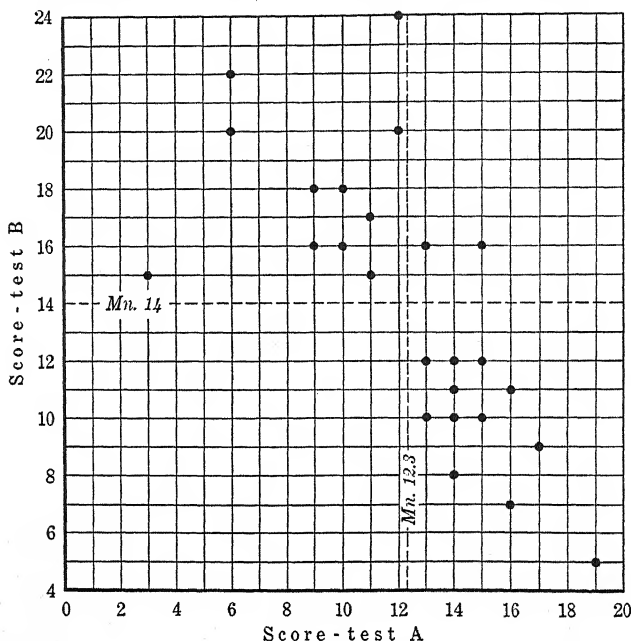


FIG. 14. Scatter diagram

effected without transposing any of the values from interval into unit values. If the mean averages or standard deviations are desired, they may be found from the data here given.

The scatter diagram. A graphic method of ascertaining the trend of correlation and showing the relative standing of pupils in two sets of measures is illustrated in Fig. 14. A horizontal (X) scale and a vertical (Y) scale are planned

so that they extend from the same point at the lower left-hand corner. On the X scale is arranged the index for series A, and on the Y scale the index for series B. Now look at the first pair of measures, 6 and 20. On the base scale locate 6, trace the ordinate at this index up to the point where the other scale records 20, and fix a dot at this junction. Repeat this with each pair of measures in order, taking care not to mix the scales. If two or more cases have the same pair of scores, the dots should be placed separately, but close together. The distribution of the dots shows clearly the trend of the correlation and gives some idea of the amount of negative correlation present. Identification of the individuals by means of a number or initials placed by each dot adds to the usefulness of the diagram. The placing of the lines for the means (as is done here) or the medians is an aid to interpretation. One may also indicate the norms for tests, or the quartile or other percentile values.

RELIABILITY

In arriving at any statistical computation, one should keep in mind that it is not an absolute figure but one which is always relative to the total situation. There are many chance factors that affect the collection of the original data. For example, if the data be the result of tests, even when the tests are accurately given, some of the subjects will receive a higher or a lower score under the given conditions than would have been the case with different conditions of health, temperature, attitude, incidental distractions, and many other items. The larger the number of subjects in a group, the more such errors tend to be neutralized. The more homogeneous the group is, the less likelihood there is that the computation found differs greatly from what might be considered a true figure.

The normal probability or frequency curve is used as a

basis in estimating the chances of a measure's falling within certain ranges on the scale. For example, the mean average which is computed for certain data is considered as falling at the mid-point (median, mean, and mode) of an infinite number of means that might have been found, either for the same group under other chance variations in conditions or for similar groups selected from the larger "universe" of which they are a part. The Probable Error (P.E.) is most frequently used as a measure of reliability or unreliability, as it is easily understood. It is the Quartile Deviation of the normal curve. When laid off on either side of the mid-point of the normal curve, it includes 50 per cent of the cases. The chances are even, then, that the true computation will lie within the range of 1 P.E. above and 1 P.E. below the one found, expressed \pm P.E. The abbreviation "P.E." is generally omitted in such expressions as Mean = 42.8 ± 1.3 . The chances are 82 to 18 approximately, or 82 out of 100, that the true measure will fall within the range ± 2 P.E. Tables which give the areas of the normal curve that are included within various distances from the mid-point in terms of P.E. are to be found in most of the texts on statistics and should be used for more complete interpretation.

Some of the most common formulæ are:

$$\text{P.E. of the Mean (P.E.}_{Mn}) = \frac{.6745 \text{ S.D.}}{\sqrt{N}}$$

$$\text{P.E. of the Median (P.E.}_{Md}) = \frac{.8454 \text{ S.D.}}{\sqrt{N}}$$

$$\text{P.E. of the Standard Deviation (P.E.}_{\sigma}) = .6745 \frac{\text{S.D.}}{\sqrt{2N}}$$

$$\text{P.E. of Coefficient of Correlation (P.E.}_{r}) = .6745 \frac{1 - r^2}{\sqrt{N}}$$

Applying the appropriate formula to the data of Table X and using the standard deviation found (p. 334), the P.E._{Mn} is computed $.6745 \frac{3.16}{\sqrt{30}}$ which equals .4. The Mean then equals $14.1 \pm .4$. The chances are 50 out of 100 that the true mean lies somewhere in the range 13.7 – 14.5. When applied to r , the coefficient must be at least four times its Probable Error to be significant. Thus a very low correlation may be found to be significant, as in the case of $r = .060 \pm .008$.

No measure of reliability corrects for any basic error in the collection of data. Those who are planning to conduct experimental work in which data are collected and treated statistically should master the concept of reliability, especially as it is applied in the analysis of the differences between computations (H. E. Garrett, "Statistics in Psychology and Education," pp. 118-148).

QUESTIONS AND EXERCISES

1. There is some dispute as to whether statistics is a separate branch of mathematical science or whether it is a method. What is your opinion?

2. State an experimental problem in educational psychology which will call for statistical treatment of results. Show definitely what techniques will be needed.

3. State a problem of educational psychology in the solution of which statistics will play no part. Explain clearly.

4. Find, in an educational periodical, such as *The Journal of Educational Research*, *School and Society*, *School Review*, *The Journal of Educational Psychology*, *Teachers College Record*, *Elementary School Journal*, a report of a scientific investigation making use of statistics, and note the following facts:

a. Author's name and initials; title of article and of journal; month, day, and year; volume, number, and pages.

d. Make a frequency table from the data of Table V, beginning with 54 and using class intervals of 6.

e. Give the percentile ranks of the following distribution :

SCORE	<i>f</i>
25-27	2
22-24	3
19-21	6
16-18	5
13-15	8
10-12	4
7-9	1

f. Find the median of the scores given in e.

g. Find the mean of the scores given in e.

h. Compare these with the mode for the same distribution.

i. Make a histogram and a polygon of this distribution, and indicate the mean on each.

j. Compute the quartile deviation, the mean deviation, and the standard deviation for the data in e, and interpret these measures.

k. Using the data given below, (1) make a scatter diagram, (2) find ρ by the Spearman rank method, and (3) find r by the product-moment method :

<i>Pupil</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Spelling score</i> . .	4	16	12	15	20	16	11	18	12	9	14	10	16	13
<i>Reading score</i> . .	14	30	32	21	40	35	20	25	16	24	28	23	36	25

Compute the P.E. for the median, mean, standard deviation, and r found above, and interpret each.

REFERENCES

- BUCKINGHAM, B. R. Research for Teachers, Chap. II, pp. 73-132. Silver, Burdett and Company, New York, 1926.
- GARRETT, H. E. Statistics in Psychology and Education. Longmans, Green & Co., New York, 1926.
- GREGORY, C. A., and RENFROW, A. W. Statistical Method in Education and Psychology. C. A. Gregory Company, Cincinnati, 1929.
- HOLZINGER, K. J. Statistical Methods for Students of Education. Ginn and Company, Boston, 1926.
- MORTON, R. L. Laboratory Exercises in Elementary Statistics. Silver, Burdett and Company, New York, 1928.

- ODELL, C. W. Educational Statistics. The Century Co., New York, 1925.
- OTIS, A. S. Statistical Methods in Educational Measurement. World Book Company, Yonkers, 1925.
- RUGG, H. O. Primer of Graphics and Statistics for Teachers. Houghton Mifflin Company, Boston, 1925.
- RUGG, H. O. Statistical Methods Applied to Education. Houghton Mifflin Company, Boston, 1925.
- THURSTONE, L. L. The Fundamentals of Statistics. The Macmillan Company, New York, 1925.
- TIEGS, E. W., and CRAWFORD C. C. Statistics for Teachers. Houghton Mifflin Company, Boston, 1930.
- WILLIAMS, J. H. Elementary Statistics. D. C. Heath and Co., New York, 1929.

PART FOUR · *Personality and Adjustment*

CHAPTER XVII

PSYCHOLOGY OF GUIDANCE

THE MEANING OF GUIDANCE

In a sense, practically the whole of a teacher's work, especially as it relates directly or indirectly to the pupil, has to do with guidance in some form. The curriculum of a school is formulated as a body of material of which the mastery is a desirable objective, and the teacher is employed as an agent by which such a mastery or near mastery is to be effected. In order to insure the attainment of the goal, the teacher must act as an intelligent and efficient guide to the pupils through the intricacies of learning. The value of the teacher to the community is to be judged by the extent to which he fulfills expectations as a guide to the pupils under his care.

According to this broad meaning of the word "guidance," every direction that the teacher gives, every discipline that he enforces, every motivation that he uses, and every item of instruction that he imparts may be regarded as a phase of guidance. The term has come, however, to have a much more specific meaning than is implied in the considerations given above. It refers not so much to the general mass instruction and administration of educational processes as to the more intimate, personal contact with and direction of the individual child with reference to his special needs. One

may be an excellent teacher of subject matter but fail in being an effective guide to the pupils. The field of guidance goes beyond the mere imparting of instruction on subjects in the curriculum and may deal with aspects of life with which no subject in the course of study is directly concerned.

TYPES OF GUIDANCE

Guidance is ordinarily treated under either or both of the headings "Educational Guidance" and "Vocational Guidance." In the former the chief concern is to secure for the individual the maximum benefit from his educational training both by adapting the educational procedures to his needs and by helping him to make the best adjustment to the educational program. In addition the proper integration of educational activities is sought in such ways as the careful ordering of sequences and groupings of courses so that the educational objective may be secured with maximum efficiency. Vocational guidance, on the other hand, is designed to direct individuals into occupations or fields of work for which they are best fitted on the basis of interests and abilities; to prevent definitely wrong choices of vocations such as would be the case if one of promising ability were to choose a "blind-alley" vocation in which there could be no real hope of advancement to a level commensurate with his ability, or if he were to take up a line of work in which he could develop no interest or for which he had no ability — "a square peg in a round hole"; to increase efficiency in work already undertaken; and, in general, to secure an economical and effective adjustment of the worker to his task.

Other types of guidance may be recognized, such as guidance in morals, civic and social relationships, health, thrift, and the proper use of leisure time. In a particular situation,

certain of these minor phases of guidance may be of greater importance to the individual than those more commonly recognized. It is doubtless true that the happiness of the individual and his usefulness to society depend upon his adjustment in these particulars as much as upon educational or vocational adjustment alone, and often more.

None of these types may be thought of as exclusive of the others. One can hardly give adequate vocational or avocational guidance without reference to the educational program. Any thorough plan of educational guidance must imply more or less clearly some general or specific vocational adjustment, and constant reference must be made to moral conduct, health, civic and social relationships, and so on. The guidance given may be designated according to type on the basis of the particular emphasis at the time. Any complete program of guidance will have all these objectives in mind and others as well.

THE NEED FOR GUIDANCE

In the preceding treatments of this text, it has been made clear that the child is plastic, with habits and attitudes susceptible to great modification. He is in a state of development, with his eventual destiny dependent not only upon his natural abilities and interests but also upon the direction in which these traits are bent.

There are some who hold to the belief that the adult should leave the child alone, to develop along the lines of his own personality and to shape his own destiny. They foresee a danger in permitting adults, teachers or parents, to stamp the impressionable child with the mark of their own personalities so that he does not develop naturally. Carried to its logical extreme, this point of view would deny to the child the privilege of participating in the rich

heritage of experience which his elders have accumulated except as he might accidentally encounter some item which was adapted to his particular needs or interests.

It is useless to talk about the advisability of *not* giving the child any guidance, since the child must be brought up in some kind of social environment and will most certainly adopt the customs, the ways of thinking, and the ideals of his associates. This will take place by purely imitative processes, if by no other way. In so far as the school, with its pupils and teachers, is a part of the social environment of the child, it must make its impression on him. The question remains merely as to whether the educational leaders will recognize their obligation to the child as something more than that of imparting instruction in basic subjects; whether this help that they may give will be purposeful, planned, and intelligent or only accidental; and whether it will be of such a nature as to aid him in his natural development rather than impose a purely artificial restraint and burden upon him.

STEPS IN GUIDANCE

A commonly accepted social principle states that the school should undertake to serve the child in every broad educational aspect in which he is not being adequately cared for by other agencies. This principle should be kept in mind. If a preliminary survey shows that other social agencies are fully accepting responsibility for guidance in aspects which are not strictly educational in type and are giving adequate direction to any or all of the pupils, the task of the school becomes coöperative rather than initiatory in relation to the pupils concerned. In those instances where such extra-school guidance is not supplied or where it is superficially or wrongly conducted, the school

has the opportunity and also the duty of initiating and forwarding a guidance program.

The first actual step in guidance is that of ascertaining individual needs. This must be done by a careful and more or less elaborate analysis. Correctness of analysis is the prime necessity; for if it is in error to any marked degree, wrong goals may be set up, the guidance program will be misplaced, and much time and energy wasted. Careful observation; job analysis; interviews with the child, his parents, and other associates; testing; and simple "try-outs" of various stimuli with a view to noting reactions are some of the most commonly used techniques. These will be discussed later in some detail.

In undertaking this analysis one must first determine whether actual or potential needs are to be sought. If the former is the purpose in mind, the needs should be recognized as relating to some definite and immediate objective and evidenced by some rather specific lack. If potential needs are sought, the objective is ordinarily more remote and general, and the need is considered in terms of characteristics or abilities which will be required in order to meet the contingencies of the predicted situation. In another sense, a potential need is one which is anticipated when it is taken for granted that the individual is to continue his development in the same line as that in which he is now directed. In any case, shortcomings may be classified as inherent deficiencies, the absence of characteristics which have failed of being acquired for lack of opportunity or other environmental reasons, and definitely wrong habits, or attitudes, or concepts, which may have been formed. They may further be classified in terms of their degree or ease of remediability.

Some form of record is a real necessity in the analysis of needs. The adviser cannot hope to function effectively

without the aid of such a written, itemized record, made and added to as the analysis proceeds. Many attempt to keep all the details regarding an individual in mind, not merely as to characteristics which obtain but also as to changes which occur. One who is thoroughly acquainted with a child may do this quite well, but he is almost certain to overlook many essential items if he depends on memory alone. Furthermore, when a child passes from the advisement of one guide to that of another, such a record is indispensable. Otherwise the new adviser is faced with the necessity of collecting much of the data again, a great waste of time and effort. In addition, some most significant items which were once collected are no longer collectible. There is a paucity of records in many school systems, which makes it practically impossible to carry on any adequate or continuous guidance program.

The form of the record will, of course, vary with the type of guidance being undertaken. A printed form which permits the checking of items or of brief statements is preferable for the sake of economy. This can be done only for the main body of the record. Other items must be original and must be written in much detail. The record should be so complete as to make practically a case history of the child. The record fulfills its function fully only when it follows the child from teacher to teacher throughout his entire school life. Notations will be constantly added through this period. Many school systems use the plan of keeping the record on file and adding to it as occasion permits, as a center of reference for follow-up work in the after-school life of the child, especially in the case of problem children, and as a check on the accuracy of earlier guidance.

As soon as the facts or series of related facts are accumulated which clearly indicate the need for special guidance of the individual, the actual guidance may be under-

taken. At any stage this guidance may take any or all of certain trends. One may, without attempting to alter the essential personal characteristics of a child, set about securing his adjustment to a situation, so that these characteristics may be more to his advantage than would otherwise be the case. This would involve the adaptation of the situation itself rather than of the individual concerned. On the other hand, one may seek to develop in a child those characteristics which will sooner or later be demanded for successful adjustment. If wrong habits, attitudes, or concepts have been formed, one must undertake some form of *remedial*, or corrective, work by which certain of these characteristics will be eliminated or replaced by correct ones. The task may be largely preventive, in the sense that wrong characteristics which might develop are headed off before they have had an opportunity for development.

Ideally, under a thorough plan of guidance from the beginning, remedial work is not necessary, since wrong steps are not taken. In actual practice, however, since no guidance is infallible and all learning is a form of trial-and-error process, remedial work is practically always a necessity. When the actual need for remedial work exists, the earlier it is ascertained and corrective measures adopted the better. This prevents the rigid fixation of wrong tendencies. The teacher who is able to anticipate wrong tendencies and to prevent them by wise guidance is definitely superior to one who waits for such tendencies to appear before making an attack on them. "A stitch in time saves nine." A positive program of guidance, well conceived and thoroughly executed, is often the best preventive of error.

Throughout all guidance work it must be kept in mind that the individual is the primary object of concern. Pupils may be organized in larger or smaller groups, according to some plan of homogeneous grouping; but the main object

of such organization is to give each child the guidance that he needs, not to treat all pupils alike or to reduce all to the same mold. To the extent that grouping causes the teacher to neglect the individual, it is to be regretted. Any form of pupil organization which makes for a maximum knowledge of the particular characteristics and needs of the individual child and for the greatest amount of practical personal help and the best adjustment is the preferable type. No form of grouping, however conceived or planned, can provide a consistently homogeneous group of pupils. Even though they may be somewhat alike in one certain characteristic, such as mental ability, health, or socioeconomic status, they will be very diverse in many if not all the other characteristics. Each individual is therefore a unique problem.

As a correlate of this consideration, one must be cautious in drawing the conclusion that the fit goal, such as an educational or vocational objective, for a child is determined by the natural group in which he is located, such as a racial or economic group. Part of the task of the guidance program is concerned with the problem of separating the individual from such a natural group and helping him to make an adjustment in an altogether new environment.

The most discouraging feature of guidance in the schools, especially in relation to those aspects which are more directly connected with educational activities, lies in the fact that the school is only one of the agencies exerting influences. Since so small a proportion of the pupil's time can be used for guidance by the school in comparison with that of other agencies, such as the home and the play associates, it is most difficult to build fixed habits or attitudes. This condition calls attention to the necessity, first, of carrying on the guidance program in the most effective way, and, sec-

only, of securing the coöperation and integration of all the agencies in putting the program into effect with every child.

The needs having been ascertained for any individual and the objective having been determined as precisely as possible at the time, the guidance program is then to be planned systematically so that there may be a gradual approach to the goal by the successive attainment of the various specific intermediate goals. Only confusion can ensue if too much is undertaken at once. Advisers may become impatient and even discouraged when progress is slow, forgetting that, like Rome, new or reformed characteristics cannot be built in a day. Alert observation, specifically directed, is necessary to discover whether desired modifications or adjustments are being secured and to determine the degree to which they are becoming firmly established. Progress in some of the more specific, concrete, and mensurable traits may be ascertained by the application of tests.

No objective should be inflexible. Constant modification may be necessary, especially as to details, as more information regarding the child is gained or as general conditions vary. After the set goal has been satisfactorily attained, new goals may and should be fixed. The task of guidance is never ended for any individual. Practical administrative considerations may, however, dictate the necessity of concentrating efforts on those individuals who are most in need of assistance and gradually to withdraw all but general supervisory care from those who have made satisfactory progress.

The specific steps in guidance may best be considered and illustrated in relation to certain types of guidance. Other illustrations and suggestions are given throughout the text, as in the chapters on "Psychology of Character" and "Personality Development and Integration."

BASIC PSYCHOLOGICAL CONSIDERATIONS

The principle of individual differences is of the greatest importance in guidance. No two pupils are in need of the same aid or present identically the same problems to the teacher. One pupil, whether through home training or other agency, may have received help in certain aspects of guidance, though he be sadly lacking in other respects. Another pupil may be quite deficient in that phase in which the first pupil is superior. These facts call attention to the primary importance of individual diagnosis at every stage and of some definite plan for meeting individual needs. Mass instruction and guidance of groups, however good it may be in itself, offers no real solution of the problem. Only as this is supplemented by individual attention to an adequate degree can the purposes of the school be effectively achieved.

The Gestalt principle of "patterns of behavior," according to which the child is considered at any time or stage of development in the light of the total situation, is most helpful. The child is the product of all the forces which have operated upon him. His advisement needs are to be interpreted, not as isolated elements, but in relation to each other. Some habits or attitudes may be very specific, but others are very general. In the latter case the modification of the individual in regard to a certain characteristic may involve a great many changes in other characteristics.

In agreement with the law of readiness, the best plan of guidance is one which places the initiative in the child. The best guide is not one who stalks ahead of the group or individual and who pursues his even course in silence, with his back turned upon his followers. Such a leader reduces the initiative of those who follow, discourages freedom, and prevents the fullest enjoyment of those whose benefit is

wholly concerned in the objective. The true leader of childhood is often found mingling with his followers, learning of their tastes and interests as well as abilities and adapting his pace and his path to these individual needs. He will often be found in the background, not driving but watchfully following, while those whom he guides are having the zest of adventuring into unknown lands.

The first requisite of guidance, therefore, is motivation. The enthusiasm of the child must be aroused and maintained. Any tendency to formalism or to dictatorial direction is to be avoided. If directions are to be given, as indeed is necessary, they should be given not as commands but as a form of advice, which is fully explained to and accepted by the child, thus becoming a real part of his complete understanding of the situation. When pupils are thus led to adopt as their own the basic knowledge of where they are going and how to arrive, they will need much less directive guidance on the way. The task becomes not so much that of compelling a motorless car to move by pure force of muscle and will as that of lightly assisting in the control and guidance of one full-powered and ready of response.

The same principle holds true in a situation in which a choice is to be made. The preferable procedure is that of letting the child have the satisfaction of making his own decisions, however much the leader himself may provide the materials for the decision and give direction to it. The decision which is made for one causes the resultant action to be foreign to the one who is forced into this line of action; and a happy adjustment, if at all possible, is seldom readily made. Furthermore, the child should have constant practice in arriving at decisions on the basis of logical considerations and of accepting the responsibility for such decisions. The guide who decides, for example, that the youth should undertake the study of law and plans his career to

this end is taking too much upon himself. About the most that can be done in many cases is so to direct the child's information and interests that he is not likely to make the wrong choice.

The pupil who is fully aware of his objective will gain much profit, and pleasure as well, in testing himself or in subjecting himself to a periodic test in order that he may discover his progress toward the goal. The cumulative tabular or graphic record of such progress is an especially valuable device in the hands of the child.

The child may be permitted some experience of failure, but only to the extent that it may be an aid to learning and an incentive for greater effort or better adjustment. This depends greatly upon the particular characteristics of the child, and needs to be carefully controlled. As a rule, success is a greater incentive than failure, and every child should have continued experience with success. This indicates that tasks should be carefully adjusted to the ability of the child at every stage of development. It also suggests the need for real mastery of every task which is a prerequisite to those that follow.

CHARACTERISTICS OF THE ADVISER

One who undertakes systematic guidance of any form has creative work of the highest type to do. Lives are to be molded and modified; destinies are to be determined; characters are to be formed; and individuals are to be assured a happier and more useful existence than would otherwise be possible. There is no form of activity which yields so much enjoyment as creative work when this is carried out to a satisfactory conclusion. But to be assured of this end, the one who guides pupils must possess certain traits, native or acquired.

There is a common assumption that teachers are not qualified to be or to become expert guides of childhood. This is by no means true. With the right training and supervision, together with a real interest in the work, the average teacher may become most efficient. In the majority of schools and school systems, special experts cannot be employed. If any guidance program is to be carried on at all, it must be placed in the hands of the instructional forces. In some cases all teachers will be given equal responsibility; in other cases one teacher may be designated to plan and administer the guidance work for certain grades or classes.

One of the primary requisites of the adviser is a lively interest in this type of work and a recognition of its value. It can never safely be left in the hands of one who carries it on as a mere routine. Furthermore, one who has a full sense of the great responsibility which is involved in guidance can be best trusted to equip himself properly for the work and to carry it on effectively.

The teacher must, first of all, have a thorough understanding of the child, especially of the child of the age with which he deals. He must be able to differentiate between those aspects of behavior which are merely indices of growth, and characteristic of certain stages of development, and those which mark true habits of undesirable conduct and attitude. This understanding should be sympathetic, with a true appreciation of the forces which are at work in shaping a child's destiny.

The counselor must be able to establish a rapport with the child so that frank confidence obtains. Fear, in any of its aspects, will inhibit confidences, as also will formalism. Without this access to the pupil's thoughts and feelings, the teacher may find himself powerless in making a true analysis. Many personnel workers and deans of boys and girls

in high school who have an expert knowledge of guidance are altogether ineffective in dealing with actual cases, because they do not have the ability to establish a close contact with the pupils concerned. The adolescent is as a rule especially difficult of approach.

The direction of guidance in any field presupposes a thorough knowledge of the field concerned. He who attempts to interest a child in a certain line of vocational or avocational interest without knowing the characteristics which are a prerequisite to success in this undertaking may not merely waste his efforts; he may actually misguide the child. Without such knowledge it would be a case of the blind leading the blind.

In addition, competence of leadership in guidance depends largely upon a thorough acquaintanceship with the tools, techniques, and materials involved in making a correct diagnosis. Even as the diagnostic physician must know how to use the stethoscope, the apparatus for making blood-tests and for ascertaining blood-pressure, and similar equipment, so the teacher should become well acquainted with tests and other methods for discovering abilities, interests, and potentialities of the individual pupil.

Correct and thorough analysis can be assured only when the guide follows a truly scientific method, involving a clear recognition of the problem, an impartial collection of as precise data as are possible under the circumstances, and an objective test of these data, together with a patient suspension of judgment until all the data are available. More harm than good has probably been done by snap judgments expressed and acted upon without any sound basis of fact.

One cannot assume that because he has the ability to make a correct analysis of advisement needs, he will therefore be able to direct the guidance program indicated. Each

calls for special abilities. One may know what is necessary to be done, yet have very little notion of how to proceed. In most fields of guidance there is a clearer knowledge of needs than there is of the methods by which desired objectives are to be attained. In both undertakings special caution is needed to prevent the adoption of the pseudo-scientific procedures which abound.

METHODS IN VOCATIONAL GUIDANCE

In the early part of the nineteenth century there was some emphasis on vocational education, chiefly agricultural, for the very poor. Later, primarily through the influence of Froebel, manual activities were introduced into the kindergarten and primary grades. During the last quarter of the century, sloyd and manual training were introduced and were gradually extended through the upper grades. The purpose of these activities was not at all vocational but educational, and they were made use of as a means of developing observation, reasoning, and will, as well as manual skill. The work was formal, and the same task was required of all pupils.

By the beginning of the twentieth century the older concept of manual training broke down, largely because of the surrender of the tenets of faculty psychology and the transfer of training; but it took a new form in vocational education, with the introduction of differentiated vocational courses and vocational high schools, as well as colleges. The primary purpose was to fit pupils for specific trades so that they might be more independent economically after dropping out of school, and so that the growing industries might be improved by more efficient workmen. The movement appears to have passed its apex, although many schools still give vocational or trade work to the children

of the lower economic classes and to those of low mental ability. Continuation schools bridge the gap between the educational institution and industry for young workers. The present trend is toward the use of such courses in developing creative attitudes and interpretations of industry and art and also in correlating them with other subjects so as to yield an integrative training in applied education.

Vocational or trade education is not vocational guidance; in fact, practically no guidance was given in the earlier vocational schools. Only since 1910 has it been increasingly recognized as an integral part of the work of the school. Formerly the pupils were placed in a vocational course or allowed to select one at random; now there is more intelligent planning and careful advisement, whether the pupil is taking or not taking a vocational course.

There are certain methods of "determining" vocational aptitude which were once used but which are now recognized as being definitely pseudo-scientific and untrustworthy. Among these is physiognomy, by which the size and shape of the skull, facial profile, or other characteristic is classified and the individual's potential ability in various vocational fields is charted. Neither psychological theory nor scientific investigation has revealed any trace of reliability in this or kindred methods, such as phrenology, handwriting analysis, palmistry, or astrology.

Aptitude tests have been developed and widely used, but scientific study of these tests has not demonstrated their value for the prognosis of individual ability in any specific vocation. These tests are planned with a view to discovering the ability of the individuals in characteristics which are essential in carrying on the specific task in mind. The test is sometimes that of doing the exact work to be required, while in other cases behavior requiring somewhat the same abilities is tested, although the content of the

test may be different. No test of this type can of itself measure the interest of the individual in the work or give any indication of one's ability to learn. Furthermore, the total situation in actual industry is altogether different from the case with a testing situation, and these differences must affect the reactions of the individual in various ways. Although many such tests show positive correlation with future performance, seldom are the predictions which they yield over 30 per cent better than pure guess. Consequently they are unsafe bases of guidance in themselves, although they may provide data which are valuable when used properly in conjunction with other data.

When properly administered and interpreted, intelligence tests may give valuable information for guidance purposes. For example, it has been found that success in a certain occupation requires a superior mental ability. If a child is proved to have the requisite ability, his chances of failure are lessened, while one who is definitely below the minimum requirement in ability may be advantageously directed into other fields. There is a danger that an adviser may take the results of one intelligence test too seriously. Only after repeated and accurate testing, preferably with an individual test, and an adequate analysis and interpretation of results in connection with other data, can sound guidance be given. High scores in an intelligence test are highly predictive of ability, but low scores may be attributable to many causes other than low intelligence. Here again the attitude of the advisee is of the greatest importance, and ability alone cannot guarantee success. Enthusiastic interest may compensate, in part at least, for lack of ability.

Either through tests or by observation of work done, special talents may be discovered and used as a cue to directing interest, either to vocational or to avocational lines of work. One may be misled into thinking that an individual pos-

sesses greater talent than is truly the case and so direct his energies along paths which prove wasteful. On the other hand, it is not easy to discover talent in its earlier and cruder stages. In any case, other elements than talent alone need to be taken into account. Furthermore, talent is more general than specific and may indicate ability to undertake any one of a large number of vocations within the general field or related fields.

Reference has been made to the importance of interest in a particular vocation as an element of guidance, but interest alone is not an adequate index. Children and adolescents are notable for their changing interests. One in his early teens may desire to be a fireman or a policeman. A little later pugilism attracts him. He then decides to be a movie actor. At no two stages of development is there a consistent interest. Another may have a persistent interest in a vocation which would be altogether unsuitable for him from the standpoint of his abilities, opportunities for progress, or other reasons. Interest may be a blind imitation or traditional acceptance of a parental vocation, or it may be born of an aversion to the parental or other occupation through the negative influence of parents or other associates.

These facts show the importance of developing an interest rather than of accepting interests as they appear. This concept is expressed in *prevocational guidance*, which has largely superseded the earlier attempts at vocational guidance. This type of guidance merely seeks to have the individual become acquainted with the facts regarding a great variety of occupations. Such facts include a description of the work to be done, present wage for beginners of various degrees of preparation, opportunities for advancement, working conditions for employees, probable future expansion of the field of work, dangers or risks involved, immaterial

rewards and satisfactions which result, type and amount of education required, and similar matters. Talks are given by representative leaders in the various occupational fields, articles and books are read which present the facts clearly, visits are made to the scenes of vocational action, and frequently some participation by the pupil in the vocation is provided. The real purpose behind such a program is to widen the horizons of the pupils so that they are no longer restricted in their choice to the narrow fields with which they have previously been acquainted, to give an opportunity for the development of interests, to provide the data on which an intelligent choice may be based, and to enrich the cultural and social concepts of the children.

Other facts, such as health, physical defects, economic conditions, home and social life, degree and character of mental abnormality, and ambition, have to be taken into account in any guidance program. This means that these facts shall not merely be accepted as they are, but that the individual child shall be so directed and aided as to overcome handicaps that may exist or to secure an adjustment to such as are not remediable.

Any complete plan of vocational guidance will follow the young worker into his job, study his reactions in the new situation, help him to avoid and correct errors, advise him in making changes, and, in general, secure the best adjustment possible in his work. Furthermore, vocational guidance should stress rather than neglect the avocational interests and abilities of the individual, and insure him the happiest and most useful lines of activity for his leisure time. One's vocation and avocation are a unit in the sense that together they compose the majority of one's total activity, and they should be properly integrated and differentiated.

METHODS IN EDUCATIONAL GUIDANCE

So many aspects of educational guidance are dealt with in other pages of the text that it will be unnecessary to present them here in much detail. Plans appropriate to typical situations will be presented.

The pupil who, on entering school or on being transferred to another school or class, finds himself in a new and strange environment is often in need of guidance until the proper adjustment is made. Fellow pupils are not always helpful; in fact, their heartless behavior sometimes aggravates the case. The rural-school pupil who transfers to a city school, the foreign child who is alone in a school made up of native-born children, and others who may be made the recipients of jokes and nicknames by their fellows, and who find many difficult problems in adjustment, need special attention. If they can be so treated as to manifest superior knowledge or ability, they will develop self-confidence and win the respect of their fellow pupils. A very bright boy nine years of age entered the ninth grade, among pupils who were much older. Their jealousy provoked many unjust attacks upon him; and had it not been for the intervention of the teachers in his behalf, he would have been thoroughly disheartened before the year was well started. Freshman week has proved of great assistance in helping the entering college students to make an easy transition to the new educational world which they are confronting. Orientation courses help them in their adjustment to the whole curriculum of the college. The work of the dean's office is indispensable when it is sympathetically conducted. Somewhat the same procedures are being introduced into the first year of high school. The junior high school generally fulfills one of its chief purposes in being a transition school.

Frequently the pupil must be shown how to study, either in the case of a particular assignment or any assignment. This calls for wise guidance. Supervised study may create an attitude of dependence on the part of the learner, rather than develop a sense of independence. The initiative of the pupil should be emphasized while his activities are being directed into economical channels until proper habits are formed. The individual characteristics of the child are taken into account in any good plan of supervised study, and care is taken not to impose a blanket rule upon all.

The diagnostic and remedial methods of instruction are an essential part of the best teaching procedures. By observation and testing the specific needs of the pupil are discovered, and met by the giving of drills and lessons appropriate to overcoming the deficiencies. This plan is in distinct contrast to that of assigning the same lesson to all pupils, regardless of their stage of previous mastery.

Grouping pupils according to their ability and differentiating the treatment of each of the groups is a form of general guidance. There is a tendency toward the use of smaller and more flexible groupings, the division being made on the basis of specific training needed rather than on the results of intelligence tests alone. Pupils who show the same deficiencies are grouped together. As soon as one evidences adequate mastery he is transferred to another group and given other help that he needs. At any time he may be put back into one of his former groups for further drill. The individual-progress plan provides the opportunity for maximum personal guidance.

In the secondary school and in college, especially, much attention must be given to helping the individual select the course of study which will best help him to reach his educational objectives, or which will make possible the selection of desirable objectives.

The boy who cannot pass the subject of elementary algebra may be prevented from selecting a scientific-technical course of study in high school, with consequent waste of effort. Another, who manifests superior ability, may be guided away from a vocational course which would not fit him for college entrance.

Many crises in school life may be averted or at least solved by careful guidance. Doubtless many pupils lose interest in school or fail in their work, even to the point of being excluded from the school, because they have not received proper guidance. A college student, after having failed and been dropped in the freshman year, returned to college, only to continue his poor record. He was given a group intelligence test and made a very low score. A special interview with him led his adviser to the conclusion that the student really had good mental ability. He then gave the student a reading test, and the result agreed with that of the intelligence test. A spelling test, a vocabulary test, and a general-information test, all given orally, yielded exactly opposite evidence. The adviser now repeated the reading test and watched the subject's eye-movements. He found that the student's eyes made random, spasmodic movements rather than regular, controlled, and progressive movements. The young man stated that he understood only a few of the words that he read and that nothing on a page seemed to have any connected meaning until he had read it over a number of times. On recommendation of the adviser, a medical examination was made, and the student was found to be suffering from a kind of palsy of the eye. When this was corrected, he became a good student and did very creditable work.

This illustration suggests the value of the interview and indicates the proper use to be made of tests. Unfortunately, it is too often true that a pupil's classification and all judg-

ment given regarding him are based merely on the results of one intelligence test. So used, the test becomes in many cases a factor in poor advisement. The case reviewed also reminds us of the necessity for the adviser to know at least some of the elements of physical diagnosis. He who undertakes the educational guidance of many children should be equipped with techniques and knowledges sufficient to detect visual and auditory defects, malnutrition, diseases of tonsils and adenoids, glandular disorders, psychoneurotic tendencies, and other factors which tend to interfere with school work and general happiness and efficiency.

Educational guidance calls for the fullest coöperation with the home and other agencies. The visiting teacher is a valued member of the staff in many schools. Through her influence children are often freed from distractions, given better habits of sleeping and eating, provided with much better and more wholesome amusement in proper degree, receive expert medical advice and treatment, are enabled to join organizations in which better environment and associates are found, and are generally directed, with benefit to them in their school work, health, morals, and social life.

In review, it can readily be seen that the task of guidance is not conceived of as complete as long as one type alone is isolated and given. Any real guidance, worthy of the name, must involve a complete analysis and proper steps to meet the individual needs. It will touch upon most if not all of the child's points of contact with the world about him, as well as his mental and physical well-being. Even as it is a serious obligation rather than a perfunctory activity, so it demands as thorough a mastery of the knowledge and practice of psychology as possible, in contrast with chance and rule-of-thumb procedures.

QUESTIONS AND EXERCISES

1. Discuss the effect of a general economic depression upon guidance programs.

2. Suggest several profitable lines of research in various types of guidance.

3. What are some of the indications that a thorough guidance program is of benefit to the individual? to society?

4. Note instances of guidance from your experience or observation which were not well conducted, and give a detailed criticism of each in the light of the principles given in this chapter and other sources.

5. State which type of guidance is represented in the illustrations following, and evaluate them:

a. A young man in business decided to go to college at the age of 24. Six weeks after having entered the freshman class he was reported as doing poorly. The dean found that he was particularly poor in history and that he was hopelessly confused and self-conscious in gymnasium and in military work, especially after having been reprimanded for errors. He was given a mental test and was found to have enough ability to do the work well. An interview revealed his interest in music and also his desire to do well in college. He was directed to take music instead of military work. He was placed under a more sympathetic instructor in gymnasium, with a special squad of problem cases. His other instructors were advised to give him special attention and to teach him how to prepare assignments and to take notes.

b. A boy 15 years of age and in the fourth grade was found to have the mental ability of a child of 10 years. He was very poor in the reasoning tests of the Binet Scale but was exceptionally good in all perception tests, visual and auditory, as well as tests of motor skill. His school curricula were revised to stress art, manual arts, and music during his few remaining years in school.

6. Cite illustrations which show the difficulty of making correct diagnoses.

7. What specific things might be done to make a foreign child feel at home in a school?
8. Distinguish between educational and vocational guidance.
9. To what extent, if at all, is educational progress conditioned by the following factors: intelligence, social intelligence, interest, emotional adjustment, special aptitudes?
10. To what extent is vocational fitness determined by these same factors? What other factors may be involved?
11. Why should educational and vocational counselors be exceptionally well prepared before they attempt any guidance work?
12. Outline a plan of guidance for your own school system.

REFERENCES

- BINGHAM, M. V., and FREYD, MAX. *Procedures in Employment Psychology*. A. W. Shaw Company, Chicago, 1926.
- BURT, H. E. *Principles of Employment Psychology*. Houghton Mifflin Company, Boston, 1926.
- FISHER, V. E., and HANNA, J. V. *The Dissatisfied Worker*. The Macmillan Company, New York, 1931.
- FREEMAN, F. N. *Mental Tests*, Chap. XV. Houghton Mifflin Company, Boston, 1926.
- GRIFFITTS, C. H. *Fundamentals of Vocational Psychology*. The Macmillan Company, New York, 1924.
- HOLLINGWORTH, H. L. *Vocational Psychology and Character Analysis*. D. Appleton and Company, New York, 1929.
- HULL, CLARK. *Aptitude Testing*. World Book Company, Yonkers, 1928.
- JONES, ARTHUR J. *Principles of Guidance*. McGraw-Hill Book Company, New York, 1930.
- KITSON, H. D. *How to Find the Right Vocation*. Harper & Brothers, New York, 1929.
- KOOS, LEONARD V., and KEFAUFER, GRAYSON N. *Guidance in Secondary Schools*. The Macmillan Company, New York, 1932.
- REAVIS, W. C. *Pupil Adjustment in Junior and Senior High Schools*. D. C. Heath & Co., Boston, 1926.
- REED, ANNA Y. *Human Waste in Education*. The Century Co., New York, 1927.
- WEST, P. V., and SKINNER, C. E. *Psychology for Social and Religious Workers*, Chap. XXVII. The Century Co., New York, 1930.

CHAPTER XVIII

PSYCHOLOGY OF CHARACTER

THE MEANING OF CHARACTER

Because of its abstractness and complexity, character is not readily defined in a formal way, although there is a general understanding of the meaning of the term. In fact, this understanding may have helped to prevent exact definition, since the need for definition is not ordinarily felt.

Broadly defined, the character of a person is the sum total of his personal traits of behavior in relation to the world about him and in particular to his fellow beings. The responses which a person makes to the multitude of stimuli give evidence of his characteristics. The tendencies of a person to behave in certain ways are also conceived of as character traits, even though the behavior itself is potential rather than overt. Thus character may be thought of as more or less synonymous with the behavior aspects of personality.

Taken in a narrower sense, as is done here, the term connotes the tendency to and habit of right decision and right conduct, and is therefore directly related to moral behavior. As such it is simply an abbreviation of "moral character." It is customary to speak of one as possessing a certain type of character or as being a character of a certain type. Thus a person who may readily be led into wrongdoing, or who does not dare to brook opposition in the cause of right, may be regarded as a "weak character" because of the dominant trait which characterizes him. The "strong char-

acter," in contrast, fits one for heroic and praiseworthy deeds in the cause of right. Any reference to one's conduct, when thus interpreted, implies worthiness or its opposite, whether specific traits such as honesty and selfishness are considered or those which are more general, such as nobility and winsomeness. The qualitative description of one's character indicates the presence or absence of certain virtues or vices, or at least the possession of certain desirable or undesirable traits. In view of the fact that there is no general agreement on the complete body of traits which make up a good character, it is evident that such judgments are to a large extent personal and subjective evaluations.

IMPORTANCE OF CHARACTER EDUCATION

No aspect of behavior is more important in social relations than character. It is certain that general social welfare and the strength of civilization depend largely upon the character of the individuals who make up society. The ultimate success and happiness of each individual, so far as they relate to social values, are dependent upon his character as it is formed or reformed during his lifetime.

In periods of great moral crisis such as that through which we have been passing in recent years, the problem of character education receives new consideration and impetus. Illegal practices and tendencies have increased tremendously. Violations of accepted moral standards have become so frequent as to bring the conviction that such standards are, at least in part, to be replaced by others. Many predict a decadence in civilization unless summary steps are taken to check these tendencies and to prevent their recurrence. Others are more optimistic and consider the movement a step in progress, in the sense that it is a revolt against the unreasoning moral absolutism of the past

and a trial-and-error search for greater freedom. Still others regard it as a passing phenomenon with no serious significance for the future.

Whatever view may be taken and whatever interpretation may be given the facts, the chaotic uncertainty regarding moral issues indicates the need for some thorough-going plan of moral education. Some reports give evidence that juvenile delinquency is increasing. Others show that youth makes up a larger proportion of the criminals than ever before. If this be the case, it may to some extent at least be attributable to the fact that the school and other social agencies have failed to supply and execute an adequate plan of character education and guidance.

Although the home must remain the chief agency in this matter, the school, as a social institution, cannot evade its particular responsibilities. It must be admitted that the school has incorporated no adequate plan of moral education. Such efforts as have been made have been sporadic and incidental. For the most part a direct attack on the problem has been left in the hands of the churches and affiliated organizations, largely because of the traditional alliance between religion and morals. When church and state were definitely separated and the teaching of religion was eliminated from the public school, direct moral education was neglected by a natural process of association, and the work of the school was concentrated on the instruction of pupils in the fundamental subjects, such as reading and arithmetic. No other institution outside the home has such a continuous and extensive contact with children as does the school, public or private. It is evident that any systematic program of character education must be largely directed and supervised by the school if it is to succeed in its purposes. Such a program must originate in a real recognition of the great need and must be based on an adequate

knowledge of the factors which are involved in character formation, as well as the psychological principles which are essential to success in the execution of the program.

THE FEASIBILITY OF CHARACTER EDUCATION

There are some who insist that character is an inborn trait or combination of traits and that it is not subject to education except in insignificant particulars. In support of this view they cite instances of those who have attained respected positions in civic life after years of struggle against most unfavorable moral environments, or note the cases of those who, though surrounded with the highest ethical influences, have become moral derelicts. According to this interpretation, character is "born, not made."

In distinct contrast, others are convinced that the character of an individual is always the product of his environment and training, and assert that one can, through directed training and guidance, make any person's character what he may desire, especially if the task is undertaken early in life. They regard all evil conduct as distinct evidence of the failure of society to guard the individual from immoral influences. This interpretation makes society fully responsible for the criminal and other evil tendencies of its members.

The mediatory point of view recognizes the limitations as well as the potentialities which are imposed by heredity, but states that, within these bounds, environment and training may operate so as to determine, not only the full expression of one's potentialities, but also the direction which they will take in specific situations. Psychological evidences point toward the soundness of this view.

Granting that the view of the environmentalists, or the latter concept in particular, is theoretically correct, the

question then arises as to whether any educational scheme can be so planned and executed as to be effective for character education. Some regard the situation as hopeless because they feel that the persuasive influence of the *Zeitgeist*, or spirit of the times, is so much stronger than any educational force which may be directed in opposition to it that the effects of the latter are certain to be meager and relatively fruitless. It must be recognized, however, that the larger social environment at any time is the crystallization of those forces which have operated in the past. Educational forces have to a great degree influenced the formation of the general spirit of any period. What an entire civilization is thinking, feeling, and doing is to a great extent explainable in the light of the common educational background.

It is certain that educational agencies cannot by a fiat obliterate all traces of the forces set free by the World War, the periods of prosperity and subsequent depression, the mechanization of life, the urbanization of population, the development of slums and breeding places for crime, the organization of gangs and groups which prey upon society, the growth of ruthless competition in business, the corruption of governmental agencies, the loss of the influence of the home as the center of guidance, the waning of the power of former influential religious sanctions for moral conduct, and other movements which have proved inimical to the formulation and practice of the highest ideals. These agencies can, however, do much in the way of forwarding counter movements, especially in preparing the younger generation to meet these and similar forces without moral disaster and to build such bodies of knowledge, attitudes, and habits as will give stability when one is confronted with the varied problems which are inevitable in the social environment.

NATIVE FACTORS

As suggested above, one's inheritance provides the basic framework on which character of one type or another may be built. The type itself and the degree to which it functions are largely dependent upon and limited by the native endowment. Illustrations will serve to make this point clearer. An individual may be feeble-minded by inheritance. He can do simple tasks and learn concrete facts. Furthermore, he can handle these concrete facts in simple reasoning in specific situations. However, abstract concepts are totally beyond his comprehension. Although he may be taught that the stealing of a penny or a nickel is wrong and may form the habit of not committing this wrong, he will not be able to generalize the rule for all coins. Even though forming such a concept for coins, it may never occur to him that it applies also to greenbacks or to property values in general, whether tangible or intangible. The character of such a one must be strictly limited by his intelligence. Needless to say he will always be in need of strictest supervision. Only by the greatest effort and prolonged guidance can he be made at all independent, so far as character itself is concerned. Motivations and appeals must be of the simplest and most primitive type. Never can there be any assurance that he will apply any general moral principle in a particular new situation.

Another enters the world with a characteristically unstable personality, attributable possibly to an inheritance of a defective neuroglandular mechanism. He is subject to sudden emotional outbursts and to extreme ranges of feeling from heights of joy to depths of despair. Impulsive decisions and acts are characteristic of his behavior. The task of building a strong, consistent, and stable character in such a personality is a tremendous if not an impossible undertaking.

Such illustrative examples of varied personality types could be multiplied endlessly. Even as the principle of heredity operates in the more extreme and unusual cases, so it will apply as well to the more normal variants. Any abnormal phase of personality or distinctive characteristic which is inherited has to be taken into account and adaptations have to be made in the light of such facts if moral guidance is to be effective.

One commonly hears reference made to the "born criminal." There is no evidence that the tendency to crime is of itself a unit characteristic transmissible by heredity. The fact that children of criminals become criminals may be explained by environmental conditions. Doubtless an individual may inherit certain structural characteristics, primarily neuroglandular in type, which give him predisposing tendencies. Such tendencies may make him comparatively susceptible to criminal influences when they are presented. If he is not subjected to these influences, he may and probably will become a useful citizen.

INSTINCTIVE TENDENCIES

The innate tendencies commonly known as instincts and emotions play a large part in the development of character. Such tendencies in themselves are neither good nor bad. However, the course of civilization has been largely the work of modifying, inhibiting, and redirecting the primitive "instincts." One who is altogether controlled by such unrefined and primitive tendencies could find no place in the civilized world. Only by a long process of conditioning does the child learn the will of society, which dictates under what circumstances he may take the property of others, fixes the limits of self-expression, orders a restraint upon emotions, and in many ways inhibits and alters the natural impulses.

Whether the native tendencies shall be good or bad in a particular situation depends upon the direction which is given them. If under strong provocation, or at a time when learned behavior is temporarily inhibited, one reverts to type or gives way to natural, impulsive acts, his character is said to be fallible in this particular. An error is made in assuming that his character has broken down completely or that he is altogether untrustworthy. Such an experience may be an adequate corrective and preventive of future occurrences. In any event, every other aspect of his character may be relatively dependable.

LEARNING AND HABIT

Though one may theorize regarding the importance of heredity in determining character, he must accept the individual as he comes into the world and, by providing the right environment, seek to direct his energies and potentialities into channels which will yield the maximum development of character. From the earliest years the child learns as a natural response to his environment and forms varied habits related to the influences which are brought to bear upon him. The laws of learning and habit formation are of the greatest significance in the formation of character.

Any form of environment provides elements which stimulate learning, either directly or indirectly. If these elements are wholesome, good conduct will be fostered. If they are unwholesome, there is much likelihood that the individual will adopt bad habits and to the same degree. Much learning takes place through imitation, either unconscious or deliberate. Suggestion also plays its part. The child who is reared in a home in which his family associates lead sordid, vicious lives is surrounded with influences which may prove significant in shaping his character along the

same lines. The things he sees done and the words he hears spoken will quite certainly be mirrored in his future behavior. Herein lies the potency of example. Pupils tend to take on the moral standards of their classroom associates.

Trial-and-error learning also plays its part in shaping character. Behavior is thereby altered or made habitual even though no specific guidance is given by others. If bad behavior is found to yield outcomes which are unsatisfactory, its continuance is discouraged. On the other hand, if the results are pleasing, such behavior tends to be repeated even in spite of advice to the contrary.

Directed training is probably of the greatest influence in character development. Requests, orders, punishment for omission and commission, and general discipline doubtless fix patterns of habit through years of childhood even as the more formal legal restrictions keep the more mature individual from violating many of the requirements of good citizenship. Ideals which have been taught the child repeatedly by story, song, maxim, and admonition make an indelible impress in memory and may greatly influence behavior.

Two errors are commonly made at this point. One may assume that the memorizing of rules for good behavior insures behavior in harmony with these rules. This is not the case. There is a wide gap between mere knowledge of what to do and performance. The child may repeat material freely but without either a comprehension of the real meaning or an acceptance of the basic principle as a guide to conduct. The second error lies in assuming that behavior alone is an index of the true character of the individual. One may have formed habits of good conduct so that there has been no significant variation in behavior from early years, only to fail in some situation requiring deliberate choice. The explanation may be found in the fact that he

has been acting somewhat like an automaton. The habits which he has formed have been imposed upon him with no conscious recognition of their value and no genuine personal acceptance of them as standards of conduct. In a crisis, especially when he is freed from watchful and compulsory controls, he may revert to the satisfaction of tendencies from which habit alone has never freed him.

These facts call attention to an aspect of character education which has been too often neglected; that is, the extension of habit to the fixation of right attitudes. The learning of rules and the formation of habits are necessary and valuable steps in character development, but they should be supplemented from earliest years by a clear, logical understanding of the principles and acts which are involved and their consequences, and by a definite feeling in relation to them. Although the control of a child may be somewhat arbitrary at certain stages and for a time, he should, as early as possible, be led to a deliberate choice of behavior in harmony with this control. Otherwise such conduct will always be more or less foreign to him, even though he practice it.

One may be subject to a partial or, in abnormal cases, a complete dissociation which leads to a double life. In one set of associations good habits operate, while there is a distinct contrast of behavior in other associations. In true dissociation one of the "individuals" may not be aware of the existence or acts of the other. Normally, however, the person is fully conscious of his behavior in varying situations. His conduct in either case is a natural response to the satisfactions afforded by the particular environment. Thus a man may be a model of kindness and benevolence on Sunday but be ruthless and egocentric on other days. The pupil may be very well-behaved while under the disciplinary guidance of the strict teacher but

be quite unruly under another teacher who does not know how to maintain control.

Habits as well as instincts are recognized as dynamic guides to conduct. If one develops consistent habits of thought, feeling, and action with regard to any specific item of conduct, these habits become prepotent tendencies which gain momentum and more and more prevent any behavior not in harmony with them. Thus, by the cumulative effect of habit, one youth may be just as thoroughly conditioned to evil as another is to good conduct.

SENTIMENTS AND IDEALS

Mention has been made of the affective motivations for conduct. Volition takes place in direct relation to the feelings. The negative motive must always be present, at least as a background, but it is unfortunate if it dominates too greatly. The positive emphasis is more certain of consistent and persistent results in so far as real character development is concerned. Let one be motivated by fear alone and his behavior will change for the worse when the occasion for fear is removed. Under this régime the most fearful and intimidated are the best-behaved, and only the very courageous dare proceed in the face of the threat of danger. In this sense, then, the strong character may be found among the violators of good conduct. When the positive elements are stressed, however, the individual's energy is directed to a definite goal necessitating the overcoming of obstacles and the meeting of challenges. Interest is sustained, and volitional habits are established.

Sentiments and ideals are primarily positive. There is no exact dividing line between the two, but the former are chiefly feelings which are directed toward certain specific objects or acts, while the latter are more or less complex

appreciations of goals which are considered worthy of achievement, together with the tendency to work toward these goals. Abstract though they be, they add greatly to the richness of character when properly directed. They are especially effective because of their emotional bearings. One has a sentiment of affection for his childhood home, and however far he may wander, he will never be altogether free of it. Sentiments are distinctly personal, and may be attached to objects, persons, and events in such a way as to be unappreciated by those who have not the identical background and experiences. They are the essential characteristics of all loyalties and are to be differentiated from the superficial and temporary displays known as "sentimentality." Ideals serve as a guiding star of endeavor and are ordinarily a stimulus to directed effort, even though they may never be fully achieved.

A sentiment or ideal which is merely ideational and which does not result in harmonious decisions and activity tends to fade out. The law of disuse operates. One may form the habit of inaction by substituting the satisfactions of daydreaming and contemplation for actual achievement, with a consequent weakening, rather than a strengthening, of real character. He may know what he should do, but enjoy the projection of himself into the task rather than actual participation. Another danger lies in indefinite postponement of decision or action.

MORAL JUDGMENT

Character can never reach full development until the individual has established habits of rational analysis which will yield satisfactory outcomes in the way of effective decisions. No pattern of conduct alone, however apt it may have been in past experiences, is adequate for dealing with

new contingencies and new problems which are unique. One must be able to analyze the elements of the situation and reach a sound solution on the basis of generalizations derived from what he has experienced and what he has learned, or can learn. This is especially true when a crisis is encountered in which there is a conflict of ideals. A youth believes that he should not withhold any truth; but on this particular occasion, if he tells all the truth, a friend will be unjustly injured. The latter outcome also would be contrary to his ideals. A sound judgment is of more value than following any set rule in such emergencies.

Only as a person thinks a principle through does he gain any real appreciation of it. It is only when he has achieved a rational acceptance of a principle of conduct that it becomes fully meaningful to him and, in fact, becomes a part of him. It is one thing to be deterred from an act merely because he is following a rule of prescribed action; but it is quite another to refrain from the act voluntarily because he has a rational understanding of the results of such an act upon his own and others' welfare and happiness.

A vivid imagination is necessary if one is to foresee the possible outcomes of behavior, but it should be rationally controlled. Otherwise the view may be unbalanced and distorted. Imagination alone may be anticlimactic and fail to square with reality, with the result that disillusionment follows.

There is a very common tendency to rationalize concerning one's behavior, and thus to find reasons and excuses for having acted in a certain way. This makes for weakness rather than strength of character. A frank recognition of an error or fault and a determination not to repeat the error is the mark of sincerity and requires true reasoning.

MEASUREMENT OF CHARACTER

Although character itself is complex and intangible, some efforts have been made in recent years to devise tests applicable to the traits involved. Most of these tests are specific psychological tests designed to measure those habits, judgments, and emotional characteristics which may be considered as directly or indirectly related to character. Some of the tests deal with such general traits as aggressiveness, persistence, degree and type of interest, confidence, and originality. Others relate very directly to character, such as tests of honesty, truthfulness, trustworthiness, unselfishness, ethical discrimination, judgment in moral dilemmas, and emotional inhibitions. Only a few tests have been devised which attempt to secure from the individual himself a reaction or act of conduct which reveals his actual character. Such a test of cheating in school work consists simply of passing their test papers back to the children for grading according to a key of correct answers which is supplied, the real answers already having been copied down during the short period ensuing after the test papers were collected. The alterations which pupils make on the papers in the way of erasing and placing correct answers can thus be detected. Another test of the same nature provides pupils with an opportunity to take small coins without being aware that they are detected in the act. Such tests are themselves subject to much criticism, as also are those who use them, because they are unethical in that they stimulate immoral acts. In every case, however, they deal with ordinary situations such as the child usually meets, and the investigators study his natural reactions in such a situation, not merely as a guide to remedial work which may be given to the individual, but also with a view to learning more concerning the moral guidance of the many.

Many of the so-called tests are simply pupil questionnaires in which the individual indicates his answers to definite queries regarding his habits and attitudes. It is evident that what a child says regarding his own attitudes may not square with the actual facts. He may answer the test items in a certain way because he knows that these answers are the ones which will be most acceptable to the teacher rather than because of any honest or objective analysis of his own convictions. Furthermore, one may have a certain verbal or even mental attitude which is not evidenced in actual behavior. The same criticisms may be made of the moral-judgment or ethical-discrimination tests.

A few of the tests are merely tests of knowledge of ethical vocabulary, moral principles, and civic standards. When thus interpreted as measures of either rote or logical memory, they may prove useful guides to further instruction along similar lines; but it should never be assumed that one is thereby securing any index to actual behavior.

Rating scales are also in common use. One type of such scale is for the use of the observer or guide, and it is valuable in the sense that it directs the attention of the recorder to specific items which might otherwise be overlooked. Although necessarily subjective in some aspects and far from reliable as a means of individual diagnosis and prognosis, it may prove useful in the hands of one who is expert in the particular field covered. The other type, the self-rating sheet, must be regarded primarily as a means of motivation. The record itself can seldom, if ever, be taken seriously.

Even though the number of measuring devices so far constructed for the analysis of character and personality traits is estimated at somewhat over a hundred, only a beginning has been made in this field. Much more will have to be done in the way of extending and revising the tests, establishing their validity and reliability, and secur-

ing adequate norms. There is a tendency for some to take the results of such tests as are available too seriously as absolute measures of character. They may be of some aid in making individual diagnoses when properly used, as well as in noting gross changes in the knowledges, habits, and attitudes of groups taken as a whole.

The theory upon which character tests have thus far been constructed may be unsound, and an altogether new line of attack may be needed. It is indeed doubtful if there is any general character trait such as dishonesty which may be said to permeate an individual's entire behavior. The trait may appear in a specific situation when certain associations are set up, and only then. No single test is able to reveal this fact. It is an extremely difficult if not an impossible task to set up any formal test which will analyze an individual's behavior in the light of the total situation or to develop norms of behavior which will make scores in any way comparable. A basic difficulty is also encountered in determining in any exact way which traits may be moral or immoral in themselves, or which may be conducive to moral or immoral behavior.

PRACTICAL SUGGESTIONS FOR CHARACTER EDUCATION

Character education is primarily a matter of wise guidance. One cannot make another's character. It must be molded by each one out of the stuff of his own experiences. All that the guide can do is so to direct the individual's activities and energies that he shall be subjected to the best and most potent influences.

There is a common belief that work, in and of itself, is a strong influence in the formation of character. It is recognized that the idle child is more likely to form bad habits than one who is kept busy, and consequently some depend

upon work, not merely as a preventive but also as a cure of bad conduct and attitudes. Work which is drudgery is certainly of questionable value and may have an effect which is opposite to that desired. A task in which a child is vitally interested will evoke all his powers and persistence until it is completed, even though it be difficult, but an imposed task may arouse discouragement and resentment and cause a diffusion of attention and energies rather than concentration. The teacher who makes a difficult assignment in arithmetic with the conviction that the pupils will thereby develop the desirable characteristic of persistence in the face of obstacles is misplacing the emphasis. The primary objective should be to make a very interesting assignment. The pupils will then approach the lesson as a real challenge. The bright child is in need of special attention in this respect. Assignments must be adapted to his ability. Very frequently tasks are too easy for the more able pupil, with the result that they provide no real challenge, and the pupil forms the habit of indolence rather than that of putting forth his best efforts.

The value of play in character formation is inadequately recognized. The attitude itself is conducive to the development of wholesome traits. A child's energy thus finds a natural, spontaneous outlet. Play is largely a social undertaking, in which the child learns to adapt himself to the will of others as well as to maintain his just rights. The interplay of interests and restraints is an effective preventive and corrective of antisocial conduct and a stimulus to leadership. Supervision of play, if it is not so directive as to destroy initiative, will serve to guide children into the most useful and valuable activities and to secure increasingly ready adjustments.

All activities undertaken, like play, should be related as largely as possible to real living, and the social element

should be stressed. In addition, they should involve the solving of real problems which will develop the habit of exercising moral judgment. If the teacher is a mere task-master and stern disciplinarian, the child is forced to give his assent to her dictates without any consideration of the rational elements involved. Problems which are stated in the form of illustrative examples, the pupil being asked to indicate the best line of conduct in a situation, may have their place in general training; but in themselves they do not tell what the child actually would do in a similar crisis, nor are they so effective for character education as real problems in living.

There have been many plans of character education which involve the adding of a course, especially devised for the purpose, to the school curriculum. This procedure is of doubtful value. Such a course is almost certain to become formalized. If it is a mere routine of memorizing moral stories, maxims, proverbs, rules of conduct, and catechisms of behavior, with examinations on such content, the course will be doomed to failure. It will neither stimulate the interest of the pupil nor give him any functional appreciation of the principles involved. Furthermore, since the content is treated as a separate subject of study, the course would isolate moral behavior from life rather than integrate the two.

A much more feasible and valuable plan is that of securing a thorough correlation of character training with every other subject of curriculum, every extra-curricular activity, and in fact every school experience. Furthermore, it should extend into the home and other community agencies which may be influential in the life of the child.

The success of such a plan and program depends primarily upon leadership. The profession of education has always been marked for its generally high standards of conduct.

The maintenance of these standards is imperative. There can be no real progress in character education in the school until the instructional forces acquire a more comprehensive view of their responsibilities in relation to it. The teacher of the grades is more than mere instructor in fundamental skills. She holds in her control those forces which may determine character and destiny. The athletic coach or physical director has significant opportunities to impart ideals which are even more important for society than the subject matter of his instruction alone. The teacher in the secondary school has the responsibility of guiding youths constructively during their most critical periods. Any school experience may be thus interpreted as the agency by which potent contacts may be established and a program of character education may be forwarded.

The teacher who assumes that the new generation is wrong has thereby erected an almost impassable barrier across the pathway of approach. No rapport can be established in an atmosphere of suspicion and criticism. In fact, children may be so repelled that they accept ideals which are contrary to those presented. Discipline, likewise, must be handled with great wisdom and an insight into the nature of the child. No form of punishment should be administered that is not truly corrective. In the first place, it should be a fair and natural imposition of a penalty for a real offense. Juvenile courts have set a model for advisers of childhood in this respect. They undertake to discover the underlying causes and extenuating circumstances of the specific case of misbehavior and to give such guidance as will be helpful in securing a better adjustment. Any disciplinary measure which is arbitrary, unreasonable, and misunderstood, and which thereby arouses enmity, stimulates fear, and encourages secrecy, is not to be considered.

In certain situations forgiveness may be very helpful in

character-building. In others, it is very destructive and should be used cautiously. When a child misbehaves, at the same time knowing the penalty which is the natural consequent of the act, and then is freed from paying the penalty or its equivalent, he may develop a disrespect for the rule of control and be encouraged to repeat the act or related acts with impunity. The failure of courts to impose adequate penalties for crimes, whether owing to graft, sentimental kindness, or other influence, has made them too often the silent partners of crime. Sooner or later the individual must learn the nature and function of law and must acquire the habit of submission to the control of law as well as a law-abiding attitude. The law of the school is one of the pupil's first contacts with real social control, and it may well be made the beginning of his systematic training for citizenship. Self-government, when properly supervised, will give the pupils a real appreciation of "liberty under the law" and a recognition of their responsible part in creating the social order.

It is indeed doubtful if character that is purposive, righteous, and unswerving can be formed without the urge of strong emotion or general emotional tone. An ideal which is merely rational may leave one passive, but one which is set in terms of strong desire begets action. Religion at its best has served well in the past to stimulate high endeavor, and doubtless will continue to do so. Something of the same emotional urge is needed to supplement all that educators can do in the way of imparting knowledges and developing habits. The characteristics of such an emotional force will be, not a selfish personal fear of present or remote consequences, but rather an absorbing desire to be of help to one's fellows and, through them, to all succeeding generations. In the margin, or fringe, of consciousness will be the fear of failure, but the chief negative motivation will

be the wish to do nothing which will in any way cause human unhappiness and misery.

As yet we have not learned the technique of imparting such a basic urge. It is certain that it cannot be born out of the ordinary routine of lesson performance or academic discussion. The vital spark must be kindled in the flame of others' convictions, and only as educational leadership has imparted and can impart this potent influence can the work of character education be carried on with full success.

THE SCHOOL AND OTHER SOCIAL AGENCIES

Evidence shows that the criminal and delinquent either have had relatively less schooling or have been more retarded in school work than others. Although illiteracy may not be the cause of crime, a larger proportion of criminals are illiterate than is true of the population as a whole. Education is at least associated with the factors which make for good citizenship.

The school could do much more than it is now doing, not merely in improving its own procedures in character training but also in molding public opinion. By direct appeal to the home and by discussion in the classroom, evil influences in the community which make wrong conduct attractive may be combated. Political graft and inefficiency in governmental affairs, especially as they are related to law and order, might be exposed, even as their opposites might be recognized. In coöperation with other community agencies, higher social standards may be established.

The school should be especially active in securing the establishment of supervised playgrounds, recreational centers, clubs, and other institutions and methods which will keep the children helpfully active during their out-of-school hours. The school building itself may and should become

a real community center, to be used not only for classwork but also for carrying on any activity which will promote a wholesome civic life.

Work with the behavior-problem child is of major importance. All community agencies should cooperate in making it a success. It can no longer be regarded as a fad; on the contrary, it deserves fullest support. Teachers need special preparation for dealing with involved problems and procedures. Adequate systems of records are essential. The visiting teacher, who goes to the home, performs a valuable service in investigating cases of misbehavior and in recommending further study and treatment of the cases. The physician, the psychologist, the psychiatrist, the social workers, may give invaluable assistance in dealing with particular cases as well as in setting up the local program of preventive and corrective work.

In their concern for these problem cases, the potential criminals, the schools may lose sight of the more normal individuals who, unless they acquire the right knowledges, habits, attitudes, and ideals, will too often adopt the worst elements of the social order and be destructive rather than constructive forces.

The move toward adult education in recent years also extends the influence of the school in imparting civic ideals to immigrants, in securing better cooperation of parents, and in integrating all community agencies in a program of character training.

QUESTIONS AND EXERCISES

1. William James said, "Do every day something for no other reason than that you would rather not do it." Estimate the value of this advice as it relates to character education.

2. Discuss training in the proper use of leisure time as an element of moral education.

3. Show that subservience is not an ideal goal and indicate how this end may be avoided in moral training.
4. In what ways is health related to character?
5. Does it appear likely that scientific sanctions of ethical behavior will be set up in the near or remote future? Justify your answer.
6. Are strength and goodness of character synonymous?
7. Show by illustrations how correlation of character education and other school activities may be effected.
8. Cite instances from your experience where character has been misjudged.
9. How would you direct the child who tells falsehoods as a natural expression of a vivid imagination? How would your treatment differ in the case of one whose lies are attributable to a defense mechanism?
10. Evaluate some plan of character education with which you are acquainted.

REFERENCES

- CHARTERS, W. W. *The Teaching of Ideals*. The Macmillan Company, New York, 1926.
- DEWEY, JOHN. *Human Nature and Conduct*. Henry Holt and Company, New York, 1922.
- GERMANE, C. E., and GERMANE, EDITH G. *Character Education*. Silver, Burdett and Company, New York, 1929.
- HARTSHORNE, HUGH, and MAY, MARK A. *Studies in Deceit*. The Macmillan Company, New York, 1928.
- KLAGES, LUDWIG. *The Science of Character*. Sci.-Art Publishers, Cambridge (Massachusetts), 1932.
- MACCUNN, JOHN. *The Making of Character*. The Macmillan Company, New York, 1900.
- MARTIN, H. M. *The Formative Factors in Character*. Longmans, Green & Co., New York, 1925.
- ROBACK, A. A. *The Psychology of Character*. Harcourt, Brace and Company, New York, 1928.
- SHAND, ALEXANDER F. *Foundations of Character*. The Macmillan Company, New York, 1914.
- SYMONDS, P. M. *The Nature of Conduct*. The Macmillan Company, New York, 1928.

- American Educational Research Association, *Review of Educational Research*, June, 1932.
- National Education Association, Committee on Character Education, *Bulletin No. 4*, United States Bureau of Education, Washington, D.C., 1926.
- National Education Association, Department of Classroom Teachers, "The Classroom Teacher and Character Education," Seventh Yearbook, 1932.
- National Education Association, Department of Superintendence, "Character Education," Tenth Yearbook, 1932.
- National Education Association, Division of Research, *Crime Prevention Through Education*, Vol. X, No. 4 (September, 1932).

CHAPTER XIX

PERSONALITY DEVELOPMENT AND INTEGRATION

In the preceding pages we have studied the structure, function, and organization of the nervous system. We have learned how the acquisition of knowledge and skill takes place. We have acquired some knowledge of how to measure skill and mental ability. It is the purpose of this and the following chapter to discuss the individual qualities, acquired and innate, which are revealed in personal conduct and behavior.

The individual is an organized system of reflexes and habits. These reflexes and habits do not exist alone. They are all organized into systems, or patterns. The skill required in driving a car is made up of many habitual reactions organized into a system of responses. With these responses go judgments which are needed in each important turn of events. Habits function successfully only where reactions of limited types are required. In cases where definite decisions must be made, more is required than innate or acquired habitual responses. Habit responses are not independent. Each habit reaction is a part of a larger habit reaction. One system of habits is only a part of a larger system of habits. Each system of habit reactions affects every other system of habit reactions. This interplay of habitual responses is a very important factor in the development of an effective life. The interrelationship of man's acting, feeling, and thinking determines his personality. The organization of our individual characteristics as expressed in our behavior reactions may determine our personality.

Our personality may be conditioned by our physical state. This includes the functioning of the endocrine glands, the condition of the blood, the working of the digestive tract, and the neuromuscular mechanism, or patterns of habitual responses.

Mental deficiency, insanity, and criminality, which appear to be increasing at an alarming rate, may be accounted for either by organic or by functional disorders. Disorders of the functional activity of the cells in man are responsible for the existence of many persons who are in greater or less degree removed from the normal and who are unable to adapt themselves to the environments in which they must live. Cases arising from glandular or other functional disorders have pathological conditions that are remediable in whole or in part. Emotional disturbances caused by homesickness, domestic troubles, worry, fear, an unnatural environment, focal infections, diseases, malnutrition, and such extrinsic poisons as alcohol, lead, and nicotine are very largely the cause of the lack of chemical balance.

To comprehend the ætiology, or specific causes, of the disturbances which are responsible for the existence of many mental defectives, we must consider the life processes of the living cells. There are only three processes involved: the nutritive, the formative, and the functional. The nutritive process is that activity by which the cell takes nutriment from the surrounding element and stores it as potential energy. The formative process has to do with cell division. It is the process by which organisms grow and develop. The functional process is concerned with specific action, such as the contraction of the muscle cell, the secretion of a gland cell, and the transmission of a nerve impulse. The cells, like all living organisms, engage in three principal activities: (1) feeding, (2) growing, and (3) functioning.

We have here a partial explanation of the problem of

mental defectives. The formative process of the cells in the human embryo is dependent upon a chemically normal medium, a healthy condition of the mother's blood. If the embryo receives a well-balanced food supply, it will probably develop into a normal individual.

In some cases of mental defectives, where the cause is to be found in the abnormal functioning of the endocrines, effective treatment can be given. This is especially true of children in whom the thyroid gland is absent and those in whom it is undeveloped in varying degrees. In either instance it is apparent that the formative activity in the cells of the child has been selectively inhibited, but that only the thyroid is primarily involved. The earlier the treatment is started, the better will be the results secured.

Mongolism is another type of defect apparently caused by the abnormal functioning of the endocrines. There have been three theories purporting to explain this phenomenon. It was once thought to be the result of syphilis in either a parent or a grandparent. The Wassermann test for syphilis has eliminated this theory. Another theory is that Mongolism is an inherited trend, or atavism, to the ancient orangoid stage of development. The most accepted theory held today is that this defect is an endocrine disorder caused by prenatal chemical influence on the fetus, causing an abnormal formative activity of the cells of the embryo. Mongolism is a more serious disorder than cretinism and yields to treatment to a less degree. Whereas cretinism is a uniglandular disturbance, Mongolism is in all probability a pluriglandular one. The functional disorders of the endocrine glands are progressive. A bad hormone balance irritates the nervous system, and this in turn upsets the glands, causing them to function still more abnormally, with the result of still greater injury in the neurones.

GLANDULAR INSTABILITY AND CRIMINALITY

It has been estimated that at least one third of all present convicts are suffering from emotional instability arising from gland or toxic disturbances. If this is true, it follows that they should receive medical treatment. The behavior of the great army of youth and adults in our penal institutions might be partly corrected through treatment of the endocrines. The less pronounced peculiarities of conduct and character of many school children are probably due to the same cause. It is possible that some of the "bad" boys and girls in school need medical attention. Much of the so-called wickedness of school children is probably a condition caused by improper functioning of parts of the body.

The chromosomes and the hormones each have their rôle to play in the direction of development. The most tenable hypothesis of the nature of the chromosomes is, indeed, that they are packages of enzymes which activate the metabolic processes of the early stages of development, just as the hormones of the endocrine glands control metabolism in later stages. The hypothesis may be suggested that the chromosomes direct the early stages of development and create certain centers of chemical activity to which they hand over the business of differentiation of particular parts. Thus the chromosomes may work indirectly in establishing certain centers of later chemical activity whose course they have determined, but in the working of whose mechanism they subsequently do not interfere. The endocrine glands of vertebrates represent perhaps a still later and highly specialized stage in the series of regulators of metabolism. . . . No physiologist can fail to recognize that all development is under the control of agencies external to the developing center. . . . The nervous system is, of course, the organic complex which is most directly affected by external conditions and the production of hormones which has so marked an influence upon development. . . . Various kinds of shocks, or poisons introduced into the body, affect the development of

the fetus. . . . The student of genetics must take into account, therefore, chromosomes, hormones, other developmental impulses, and environmental conditions if he would understand all factors that determine development.¹

ELEMENTS OF THE PERSONALITY

The elements that go to make up a personality are many. In order that they may function effectively, they must be integrated into a smoothly working whole. Biologists and psychologists are pretty well agreed that the original equipment of man, together with his acquired traits and the influence of the environment, are factors in his personality development. An individual is a product of his inheritance and the environment in which he lives. When there is a proper interrelationship between these factors or forces, normality may be expected to result. It is an accepted fact that we are all the product of inherited potentialities influenced by the particular environmental forces acting upon this equipment. A study of the social setting of an individual will show clearly the causal factors that may have produced the individual's twists of personality.

EARLY YEARS ARE IMPORTANT

Early childhood is an interesting period of life. It is a period of great plasticity, a time when impressions may readily be made. If we desire a child to develop into a useful adult, we must avert his making the wrong start during the early years of life. During these years the home is the most important factor in child development. The personalities of those who come into contact with him make, to a large extent, the forces which affect him during

¹ Charles B. Davenport, "Chromosomes, Endocrines, and Heredity," *The Scientific Monthly*, Vol. XX, May, 1925, pp. 491-498.

his formative, impressionable years. The fact that he is plastic and suggestible is of utmost importance. His surroundings should be such as will result in a calm atmosphere, devoid of friction. The poverty-stricken home, or the home where the father has one ambition and the mother another ambition, and where there is continuous quarreling over their personal affairs or the methods of rearing the children, may result in wrecking the child's future welfare. The outlook that the individual takes on many of the important points in human life may be started from the conditions surrounding him during his early, growing, plastic years. Most of these come in relation to family life. Harmony in family life is one of the essential conditions for normality. During many years of a child's life he is totally dependent upon others for his living and his comforts. Gradually he becomes independent; he grows into a well-rounded individual and is able to stand on his own feet. No child can develop into a normal individual who is forever made dependent upon someone else. He must have freedom, opportunity to express himself, and a chance to work out his own problems. He may need guidance. Independence of action or dependency is largely a matter of habit. Training in independence is a matter of habit formation.

JUDGING THE PERSONALITY

The personality of an individual cannot be determined merely by watching his everyday habit reactions for a short period of time. The complete make-up of an individual can be adequately expressed only in his behavior during the course of many months or even years. Real knowledge of the personality of an individual depends upon a knowledge of the forces that have been at work with him. This can be revealed only through an extensive study of the

history of the forces that aided in his development. An insight into the individual's personality may be obtained through his habitual reactions and his responses to the external stimuli and environment about him. It may also be revealed in his form of thinking. His ideation may represent important events in his life. It is possible that through his imagination and thinking, events may have been imagined that have never occurred in his experiences. Through these we may learn much of a personality even if we cannot observe its past developments.

Psychologists believe that everything we experience influences our character and personality. The very nature of the individual, both native and acquired, is affected by external and internal stimulation and thus affects the organization of the existing store of experiences through the psychological factors of memory, imagination, and association. Our personality is a product of what we come into the world with and what we have acquired through the years of our living. From the point of view of mental hygiene and mental health, personality must be considered as the totality of the individual's responses, physical and mental.

THE DEVELOPMENT OF THE PERSONALITY

The development of a personality is the same as that of any physiological organism. Personality may be considered as an innate psychological organization, which is primary, while the forces acting upon it, such as social environment, may be considered secondary. In the beginning the physiological organism is simple. It is relatively an undifferentiated structure. Personality at the beginning is also simple and undifferentiated. The personality begins with the beginning of life, and its integrity remains potentially the same throughout the years, although it is modified by the

various influences brought to bear upon it. It grows and develops like any other part of the human being. The basis of our personality rests in the genes of the chromosomes of the primordial cells of the germ plasm. This potential personality may be modified and changed according to the conditions in which it lives. Many aspects of personality are attributable to the influences of social stimulation. The condition of the nervous system and the chemistry of the body also have much to do with the growth and development of the personality. Undue emotional stress may affect the glands and other parts of the body. An unhappy affair, economic disturbance, an emotional upheaval, whether it be political or religious, will affect the general bodily condition of the individual and in that way will be reflected in his personality. If the individual has a good physical constitution, normal vitality, and a fairly well-balanced social environment, he will be able to survive almost any crisis without any serious maladjustment. The social factors which begin to operate at birth exert a marked influence upon the personality of the individual.

We have learned that the basis of personality begins in the germ plasm from which the individual springs. It is the development of these potentialities which result in action that determines the personality of the individual. The development of a personality may be influenced by the manner in which the child is handled in the early years of his life. A newborn child needs very careful handling and, under ordinary conditions, a great deal of letting alone. The stimulus provided by the parent or the nurse in the handling of the child will result in a reaction. The fact must be borne in mind that the outcomes of the stimulation should lead to desirable reactions. An infant who is handled with gentleness and kindness and treated with consideration will, as a rule, develop a personality and disposition which

will be happy and congenial, while, in contrast, one who is handled with a great deal of sternness and harshness may develop a nervous condition which will result in undesirable and antisocial behavior. The child is very susceptible to loud noises, to sudden changes, to confusion, and to modifications in the voice of those who attend it. All these have their effect on the growing, developing organism. Many cases of irritability, of lack in coöperativeness, of nervousness, and of stubbornness have developed as a result of the treatment by those who handled the infant during the early months and years of its life. The growing child is influenced by the personalities about him and by the opportunities given for imitation. Each individual who comes in contact with the growing child is the stimulus to some activity and to some reaction. Each reaction leaves its impress somewhere in the delicate, receptive nervous system. From the multitude of stimuli presented to the various sensory end organs of a growing child will come an organization which will be either a desirable or an undesirable personality. A child's personality depends on his experiences. If these are well balanced and well spaced, he has a chance to become a balanced, normal individual. This balance must exist at the various levels of development. He must play with children of his own physical, intellectual, and social level. The child must be given an opportunity in the social world to express himself. He must be looked upon as a growing child and not as an adult. No individual develops properly who lives an easy life. He must face problems, meet hardships, and make decisions; but he must also be able to master them and feel the pleasure that comes with success. For an individual to develop a normal personality, he must be surrounded by normal conditions. If we wish an individual to develop sympathetic tendencies,

he must observe sympathetic tendencies in others; if we want him to become a fighter, he must see others fight; if we want him to become honest, he must observe honesty in others; if we want him to be truthful, he must recognize this trait in others. It is out of the multitude of experiences that personality grows. No personality trait is developed without knowledge and practice. The individual who receives too much without any effort on his part seldom if ever develops into a normal being. The individual who is given too much sympathy may become indifferent and fail to understand human life. Inhibitions are as essential to initiative as the attainment of set goals, or ends. The pampered, spoiled child is one who has had his own way too much and who has never had an opportunity to meet opposition. There is a happy medium and a balance between restraint and freedom.

In the development of a personality a distant goal is a factor. Every normal child has ambition; everyone has developed in him sooner or later an idealism, an end toward which he desires to work. There should always be some goal toward which we are working. The individual who has no goal, who has no ambition, is a sorry sight. It has been said that when society loses its idealism it disintegrates. So with the individual who loses his idealism; he degenerates. We cease to live useful lives when we have nothing vital to work for. Only the dynamic individual grows; the individual who is passive can never develop, regardless of the amount of social influence brought about him or regardless of the potentialities which he may have within him. He must be stimulated to activity. Activity results in growth. It is essential to have a favorable social environment in order that the potentialities within the individual may be developed and expressed.

Development of a personality is a matter of learning. It is just as much an outcome of the learning process as is the acquisition of skill in mathematics or the formation of ideals in the field of philosophy. As the child grows, his personality grows; and as his personality expands, he may come into conflict with his social environment. Out of this conflict there should grow strength, power, discrimination, and ability to meet the conditions in which he finds himself. These will eventuate only if productive inhibitions are developed. In the development of a personality there should be some restraint, but not enough to produce inertia or to suppress desire for advancement. The individual who is in constant conflict with his environment and always at variance with those about him has a maladjusted personality that is fighting for its existence. An individual will not only fight for his existence, but he will also fight for the preservation of his ideals that are well established. Whenever there is a strong desire that has not been satisfied, he will want to satisfy this desire and will fight to that end. One of the evidences of a healthy, wholesome personality is equilibrium. We are always working toward this equilibrium, whether it be physical, intellectual, or emotional. The integration of a personality is a normal process, while disintegration is a disturbing element and we use many different ways to resist it. We rationalize, we become introverts or extroverts, we sublimate, and try in every way to bring about a state of equilibrium and normal balance.

HOW CAN WE KNOW OUR OWN PERSONALITY?

It is relatively easy to understand the personality of another individual. We know that this can be done by careful observation and checking, but to understand our own personality is a difficult problem. We know that the

study of another personality requires more than merely looking at the individual. It necessitates watching and interpreting his actions for a long period of time in the various situations in which we find him. In a similar way only prolonged experience can give us an adequate knowledge of our own personality. Our notion of our own personality is acquired from our experiences with other people and from our self-observations. The knowledge we have of ourselves is always in relation to the knowledge we have of someone else. We are continually interpreting the actions of others in terms of what we know about ourselves, and we are constantly interpreting our own actions in terms of what we know about others.

A healthy personality is a properly integrated system of habits. In a well-balanced, integrated individual, the habit systems operate in harmony with each other. An individual usually has a number of major interests, one of which predominates. Together with these he has a number of minor interests which help him in his recreation and in his various pursuits of happiness. The one who is dominated by too many purposes is sure to have habit systems which will interfere with his major or minor interests. A successful man has one predominating personality trait, one big interest, one ambitious desire toward which he directs all his effort. It is a fine thing to have a large number of different interests, but there must be a definite order and value among these interests. Dominating interests are essential to success. Most of us have a few harmonious habit systems that dominate our personalities. We all have varying interests, such as those which pertain to our daily work or profession and those that center around our home, or the home we hope to have. Others relate to our sports, or recreational activities, and still others to the interests we have in philanthropy and the welfare of those about us.

A large number of well-integrated interests in the larger aspects of human life is one of the best guarantees against useless worry and discontent. Without such interests we are liable to disturbances of personality which may be disastrous to our efficiency.

Wholesome, interesting work is the best relief from worry, irritability, and discontent; and happy is the individual who has plenty of it. The cure of many of the disturbances in individuals can be achieved by more work, not less work. The more wholesome activities the individual is engaged in, the better he will be. We should be kept so busy that we shall disregard the trivial changes and conditions about us. We shall not then be worried about health, or wonder if someone is talking about us. Our interests will be centered in our thinking and acting on the larger problems before us. The hard-working man or woman has very little time to be mentally ill. Every individual should have a life work and a life interest. For successful living man needs the guidance which some strong interest can furnish. There are no two individuals exactly alike, and this fact suggests that personalities may be organized around different systems of habits and interests.

The environment in which we live furnishes the stimulus for our interests. The child reared in a large city will usually have interests in business, while the child reared in the rural community may have his interests centered in the agricultural pursuits about him, and the youth reared at an army post may have military interests. The same rule obtains for those reared in the homes of professionally trained individuals. It is not an uncommon thing to find the son of a minister becoming a minister, the son of a lawyer studying law, and the son of a doctor studying medicine. The silent forces acting upon the individual will be reflected later in his choice of a life work. Our environ-

ment and our experiences determine to a large degree what we shall become and what we shall do. The major interest in each home has its influence and effect upon the children of that home.

It is difficult for one to tell another how to build his personality, just what habit systems should be included, and just how much emphasis should be given to this or that interest and effort. The individual must, to a large degree, choose his own line of activities and interests. If we study the personalities about us that are the soundest and strongest and that stand up against the greatest stress and strain, we shall find that these personalities are based solidly on the reality of the world about them. It is natural to think and dream along the line of our leading ambition. The greatest achievements of man are first worked out in thought and in imagination. If we are dominated by interests which have no relation to real living or to our daily work, either the one or the other will be neglected.

Psychologists and biologists have accepted the statement that personality is a result of both the inheritance and the environment. It is of no importance to argue which is more prominent, the inherited or the acquired characteristics or traits. The most important fact to remember is that there should be a proper integration of the inherited and acquired factors. It is not one particular element of the nervous system or of the body that may affect or aid in the development of a personality; all of them are involved.

A great deal of work has been done in the measurement of differences between individuals. This has been possible in many traits and capacities. Many of the differences between individuals can be objectively measured. When the methods of testing have been refined, it may be possible to measure certain traits of personality and character as accurately as traits have been measured in the field of intel-

ligence. Whether their distribution is similar to that of intelligence is yet problematical. It is a well-known fact that every personality possesses some individuality or uniqueness. It may be assumed that it will some day be possible to discover the quality and amount of those specific factors which contribute to the distinctive pattern of any individual's personality.

The fact that all individuals differ and have different types of organization does not imply that their personalities are entirely different. One individual differs from another, yet each one has a continuity of behavior and a consistency of reactions. The fact that a personality is composed of many different traits that are organized in a different way from any other makes it unique. In the development of a personality there must be integration; there must also be continuity of action. One who would build a strong personality must be persistent; he must be well coördinated, and there must be some consistency in his actions. A total personality involves a large number of different factors. These different factors or traits or conditions must be organized into a unity that will function in a reliable way. There must be a relationship between the memory, feelings, and emotions. The core from which our personality develops is found in the life impulses and native tendencies of the individual.

A normal individual is well integrated; he reveals a consistency in his actions, and a harmonious relationship between all his traits. The normal individual has an integrated and balanced personality. A dissociated personality is one in which unity, consistency, and continuity do not exist; or, if they do, only in a very limited, disorganized way. This condition may be either temporary or permanent.

Biological integration seems to be innate. It is found among animals and plants. Social integration is the process

of unifying the various elements within the individual and the social environment. In the various forms of animal life we find evidence of social integration, just as we find evidence of integration between various parts and organs of the body. There is a deep-seated tendency toward integration of both types. All purposive activities require attention, and attention leads to integration. The student who gives undivided attention to the problem at hand must be integrated; and this attention, for educational purposes, is one of the most important factors involved in personal development. The power to give attention, to narrow the field of consciousness to a focus, to use one's ability in the solution of the problem at hand, is an illustration of a form of integration. In all life there seems to be a tendency toward integration. Even in the disturbed personality, where dissociation has taken place, tendencies toward equilibrium and integration are discernible. With the physiological development of an individual there comes the increased ability to coördinate his inner tendencies and experiences to his environment. Child says:

It appears that leadership, dominance, the pacemaker, play essentially the same rôle in social as in physiological integration. Moreover, if the conclusions advanced are correct, there is the physiological continuity, not simply from the physiological gradient to the fully developed organism, but to the dominance of the idea in intelligent social integration.¹

A healthy, normal individual is usually a healthy, normal, and well-integrated personality. Proper relations exist between him and his external world, between the various parts of his own body, between his seeking and his conduct, between his behavior and the behavior of others. In the development of a personality there must be integration on

¹ C. M. Child, *Physiological Foundations of Behavior*, p. 287. Henry Holt and Company, 1924.

higher and higher levels. Character in its best form means integration on the highest level. It is the business of education to develop the power to integrate on higher and higher levels of complex life. Burnham says :

Involved in the preservation and development of the wholesome personality are such significant attitudes as confidence, the attitude of facing difficulties, the sense of humor, the learning attitude, and the objective attitude. Integration is the most fundamental characteristic of the wholesome personality.¹

PERSONALITY DEVELOPMENT AND INTEGRATION — A GRADUAL PROCESS

In summary we may say that a personality is developed because of the organic structure of the individual and because of the ability to form habits which are so related to each other that they are integrated into a whole. The whole, or total, personality is made up of innumerable traits, each related to the other in some way. The process of integration is the process by which each trait is merged with others so that they work in harmonious relationship. The gradual formation of habits is the best evidence of the formation of an integrated, wholesome personality. To form these habits in the right relationship requires a great deal of attention on the part of the one who is forming them, and constant vigilance and care on the part of those who are directing the activities which will lead to the formation of these habits. It is a gradual process. It is by persistence in the same interest, the pursuit of the same idea and ideal, that perfection in whatever we desire to do is attained. The expert is developed as a result of many hours of arduous work; his power comes as a result of his being willing to submit to the discipline necessary for skillful formation.

¹ W. H. Burnham, *The Wholesome Personality*, p. 217. D. Appleton and Company, 1922.

QUESTIONS

1. Name the factors of human personality.
2. Why is it essential to have the factors of a personality interrelated?
3. Explain how integration is a factor in the development of personality.
4. How may the functioning of the endocrine glands affect the development of personality?
5. List the forces or factors that may affect the direction of personality development.
6. How may the different factors of the personality function vicariously?
7. What is meant by the continuity of the personality?
8. Are there types of personalities? Explain.
9. How may the individual differences in personalities be measured?
10. How would you go about developing a personality?

REFERENCES

- BAGBY, E. *The Psychology of Personality*. Henry Holt and Company, New York, 1928.
- BURNHAM, W. H. *The Normal Mind*. D. Appleton and Company, New York, 1924.
- BURNHAM, W. H. *The Wholesome Personality*, Chaps. I, III, V, VI. D. Appleton and Company, New York, 1932.
- JENNINGS, H. S. *The Biological Basis of Human Nature*. W. W. Norton & Company, New York, 1930.
- MORGAN, J. J. B. *The Psychology of Abnormal People*. Longmans, Green & Co., New York, 1928.
- PRINCE, MORTON. *Problems of Personality*, Chaps. VI, XIX. Harcourt, Brace and Company, New York, 1925.
- STRECHER, E. A., and APPEL, K. E. *Discovering Ourselves*. The Macmillan Company, New York, 1931.
- WHEELER, R. H., and PERKINS, F. T. *Principles of Mental Development*, Chap. XII. Thomas Y. Crowell Company, New York, 1932.

CHAPTER XX

PERSONALITY DEFECTS AND ADJUSTMENTS

One of the most important aims of education is to keep the normal child normal. While we are primarily interested in the normal individual, many personality disorders which develop during life call for special attention. Many of the beginnings of psychoneuroses occur in the early years of childhood. Many abnormal psychological manifestations develop during the adolescent period, or even later in life. They must all receive attention. The object of a discussion of personality defects and adjustments is to give the student an idea of what takes place when an individual becomes disorganized in his normal reactions. The causes of much of this maladjustment to the normal conditions of life may be in the lack of development of wholesome and abiding interests, the lack of a proper task with some significance, the lack of an opportunity to assume some responsibility for this task and of freedom to carry it out, the lack of normal domestic and social life, and inadequate training in the control of one's emotions. A well-integrated personality can be acquired only through the building of habitual reactions in tasks which seem significant and which stimulate the proper emotions.

The object of mental hygiene is the prevention of mental disorders and the promotion of sane behavior. It aims not only at the removal and prevention of mental maladjustments but also at the development of wholesome and hygienic attitudes, habits, and interests that make for sanity, happiness, and morale. An individual's behavior may de-

viate in one or more respects from that which is generally accepted as normal. These deviations may be so slight as to escape detection, or they may be very pronounced, as is the case of those who are placed in institutions for the care of the mentally ill. In cases where there has been a deviation from the accepted normal behavior there has usually been a disturbance in the instinctive tendencies, an abnormal functioning of reflexes, or some conflicts among habits and attitudes. There may also be individual differences which facilitate deviations. A knowledge of instinctive tendencies, of reflex actions, of habit formations, of individual differences, and of the laws of learning may be used in the prevention of defects, in the promotion of well-adjusted minds, and in the keeping of the normal individual in as normal a state as possible. The outstanding hygienic need of those who tend to deviate from the normal is a sympathetic understanding of their condition. The understanding of human growth to the various stages of maturation and of development is exceedingly important in understanding mental adjustment.

Perhaps the most important work in teacher training is to teach teachers how to understand children. This is much more important than to understand curriculum construction or certain administrative procedures. It is the duty of the teacher first to understand and then to correct. It is well if this understanding be mutual between teacher and pupil. It is very difficult for one individual to understand another. Youth does not understand the adult, and parents and teachers seldom fully understand the young. The mismanagement of children in the school and in the home is owing largely to a lack of understanding of children. The fields of psychology, psychiatry, physiology, and medicine have contributed much to the understanding of human nature and its deviations. Physiology and medicine have

shown the relationship between the functions of the body and the secretions of various glands and behavior. Psychology and psychiatry have shown that mind sets and attitudes are closely correlated with behavior and that many cases of mental disorder may be prevented if these mind sets and attitudes are properly developed from infancy.

The science of mental hygiene and methods of securing mental health have reached such a degree of development that every teacher and parent should have enough available information to prevent the majority of cases of maladjustment. They must understand the use of the proper measures during the developing years of child life. The full humanizing of the teaching process can come only through a knowledge of mental hygiene and psychiatry.

PREVALENCE OF MENTAL DISORDERS

Mental disorders have been observed from the earliest times; nevertheless, it is only within recent times that the problem has been studied scientifically, with the intent of ascertaining its extent, its causes, and the possibility of its solution. In no one phase of our contemporary life has lack of political, social, and educational foresight carried its own penalty more truly than in the field of mental adjustments. The recent interest taken in this problem is most encouraging. In a survey made in 1932 by the American Foundation for Mental Hygiene it was found that there were more than 350,000 patients in hospitals for those who are mentally ill. This does not include approximately 65,000 feeble-minded individuals in institutions, nor the 10,000 patients in institutions for the epileptic. The increase in the number of patients in mental hospitals is most startling. The figures from New York State are exceedingly reliable, and they show that in 1900 there were

23,778 patients, while in 1930 there were 56,411. In the United States at large in 1904 there were 158 mental patients in state hospitals for every 100,000 population, while in 1929 there were 278. This increase in the number of patients in hospitals is not necessarily indicative of an actual increase in mental diseases, although it may well be. It may be indicative merely of the fact that more hospitals are now available, or that people are being better educated with respect to the advisability of early hospital treatment in cases of mental maladjustments. It is no longer considered a disgrace to have a relative or a friend in an institution for mental illness. It is no longer considered any more disgraceful than having a patient in the hospital for tuberculosis or cancer. Because of the increasing complexity of living, especially in the large cities, it is impossible to care for the mentally ill in their own homes. The fact that the cities and the various states of the Union are taking upon themselves the responsibility of caring for those who are mentally ill has made it possible for the people of limited circumstances to send those who are disturbed to these tax-supported institutions where they can live and be cared for free of cost.

There is some evidence that our modern civilization has, to some extent, been responsible for the actual increase in the prevalence of mental illness during recent years. Life is becoming increasingly complicated. We travel at a faster rate, there is more noise, there is more competition, there is more suffering, and all these factors contribute to mental maladjustments. Mental tension inevitably results from our changing ideas and ideals in all ethical and religious values, brought about by our changing civilization. These give rise to emotional conflict, especially in youth, and this leads to unbalance. Vast social and economic factors are working their way into the very warp and woof of our

society. Problems of delinquency, capital punishment, criminality and prison reform, immigration, feeble-mindedness, vocational adjustment, special education for the handicapped child, and other related problems go hand in hand with the problem of mental adjustment and cannot be solved intelligently without a realization of that fact.

A glance at the economic phase of the problems of mental disease will be sufficient to give us an idea of the extent and vastness of the problem. In 1928 in the United States \$91,343,752 was paid for the maintenance of mental patients; this was at the rate of \$361.71 per patient. During the same year New York State paid \$17,687,939, or \$404.82 per patient.¹ These figures give us just a glimpse of the enormous expense that mental disease is to the taxpayers. The magnitude of the problem of mental disease is almost beyond belief.

The political aspects of the problem of mental hygiene have received very little attention. Immigration demands attention. Are some races more susceptible to mental diseases and disturbances than others? Immigration schedules have been arranged with practically no scientific researches on this important question. Are some nationalities more susceptible than others to mental maladjustments on arriving in a new country and facing new problems? This problem cannot be answered until the total number of each nationality residing in a whole state is known and a careful study over a long period of time can be made to ascertain the frequency of mental disturbances. It might be that the government could do something which would make it possible for these immigrants to adjust themselves more quickly to the changed environment in which they live. The problem of unemployment also is a political and economic aspect of the problem of mental maladjustments.

¹ *Mental Hygiene Bulletin*, June, 1930, pp. 15-20.

Hospitals disclose the fact that in times of severe unemployment, war, drought, and the like, there is a noticeable increase in the admission of patients. Mental poise depends upon a feeling of security and absence of worry and fear. Another fact of significance is the gradual urbanization of the whole country. With this increasing urbanization mental disease rises. Where crowds are, syphilis is more likely to appear, and therefore more general paralysis. More alcoholism may be expected in the urban than in rural sections, and probably more nervous tension results from the more ruthless environment. Pollock says:

The rate of mental disease is higher in the cities than in rural districts. This principle, I believe, has always been true in spite of the widely circulated legend to the contrary. There is a prevalent tradition that the rate of mental disease is extremely high among farmers' wives. I have sought in vain for the origin of that tradition and for its basis in fact. We now know that farmers' wives are conspicuously free from mental disease—more so, even, than farmers; and farmers have much less mental disease than their city brothers. . . . We may, therefore, expect further increase from this cause in the rate of mental diseases from the population as a whole since cities are growing and rural communities declining.¹

PREVENTION OF MENTAL DISEASE

In order to study the possible means of prevention of mental diseases, we must look to the causes of these disturbances. There are psychiatrists who hold that heredity is the basic factor in many types of psychoses. Rosanoff,² for example, listed the following as mental disorders which develop on a hereditary basis: mental deficiency, epilepsy,

¹ H. M. Pollock, "The Future of Mental Disease from a Statistical Standpoint," *American Journal of Psychiatry*, 1924.

² A. J. Rosanoff, *Manual of Psychiatry* (Sixth Edition). John Wiley & Sons, New York, 1927.

psychoneurosis, Huntington's chorea, paranoia, dementia præcox, manic depressive psychosis, involutional melancholia, and psychopathic personality. Two of the psychoses included in this list of mental disorders, dementia præcox and manic depressive psychosis, are those occurring most frequently in the United States. According to the statistics for the United States for 1929, this list of nine psychoses would account for 50.5 per cent of all the cases of mental diseases. Other psychiatrists take a more optimistic point of view, stressing hereditary factors less and environmental conditions more. It is evident that if heredity explains these disorders, prevention of at least 50 per cent of the cases may be possible through eugenic measures extending over a long period of time.

Since there is such a difference of opinion among psychiatrists themselves on this topic, it would seem advisable to proceed along those lines where direct control of conditions in environment is possible, and to leave the topic of heredity until more scientific data are at hand. Improvement of conditions relating to syphilis and general physical health will be an important factor in the prevention of mental diseases.

In addition to these physiological and physical states of being, there are other factors of inestimable importance, such as the conditions in the home and the school. To assure that young children may be habituated to making healthy mental reactions to the situations that arise in their daily lives, and, in case unhealthy reactions are already present, that reconditioning shall take place along new and desirable reaction patterns, calls for the understanding of the principles of mental hygiene by parents and teachers and, moreover, the application of that understanding. It calls also for the application of the same principles to parents and teachers themselves, as well as

to children, in order that their undesirable mental reactions may be replaced by desirable ones. A program for improvement and prevention of mental maladjustment calls for improvement in the condition in the economic world so that poverty, unemployment, and the like shall not be permitted to take their present toll. It calls also for physical recreational activities for children, both on the farm and in the city; it demands relief of the child slave in the beet fields and industrial mills; it calls still further for provision and a sense of security for old age, for dependent children, for widows and orphans.

The schools have much to do in the prevention of mental maladjustments. The teacher has an important work to do; the schools must make adequate provision for the children of varying ability. The principle of individual differences must actually be applied in school procedure. One of the greatest factors in the prevention of mental disorders will be the provision for the special education of handicapped children, those physically, mentally, emotionally, and financially handicapped. When each child who enters our schools is given an opportunity to do that work for which he is capable and to prepare himself for some life work which will afford him happiness and security and will make him a respectable individual in his community, then will a very valuable means of prevention be begun. Pollock, in commenting on prevention, said :

Preventive measures, no doubt, are gaining ground; but I think few people realize how difficult a matter the prevention of mental disease really is. It involves a long period of research and education in a field in which there is now a deplorable lack of understanding and agreement among scientists. It involves changes in family life, changes in social habits and customs, changes in educational systems, and changes in industrial and commercial life. Our present methods of living were established

in a pre-mental-hygiene age. No thought of mental hygiene entered into their making. Perhaps some mental hygiene may be grafted on these established customs and habits. This is now being tried in a half-hearted way. But gradually, I believe, as the new science of mental hygiene develops, there will come into being new systems of human relationships, new habits, new customs, new standards and ideals that together will produce a race much healthier mentally than we are today. This will take much time as well as much thought and patience.¹

TYPES OF MENTAL DISTURBANCES

The neurotic constitution. Approximately 5 per cent of all children of school age are neurotic, and there is a still larger percentage who have more or less neurotic constitutions. A neurotic constitution implies a predisposition to strong emotions which are easily aroused and are controlled with difficulty. It also implies that this condition will interfere seriously with the individual's adjustment to his environment. A large percentage of these cases are of such a serious nature that they should receive specific hygienic and educative treatment from early infancy. A certain percentage may be able to stand the stress and strain of normal times, but a larger number are unable to stand the strain that comes during a period of depression or of other social upheaval. Since the breaking-point is easily reached, a nervous breakdown in some form may result. If hygienic and educative treatment is to be given such children from early infancy, parents and teachers must know how to detect predispositions to these disorders.

The chief characteristics on the physical side may include the following: hypersensitivity of the sense organs and of the sympathetic nervous system, frequent gastric and intestinal disorders, headaches, motor restlessness, facial tics,

¹ H. M. Pollock, "Increase in the Civil State Hospitals of New York," *Psychiatric Quarterly*, April, 1928.

speech defects, uncoördinated movements, thumb-sucking, and the shifting of the eyes. The chief characteristics on the mental side may be the following: oversensitiveness, eccentricity, great affection, fits of passion and fury, listlessness and indifference to the opinions of others, cruelty, timidity amounting to fear, jealousy, excitability, ready fatigableness from any exertion, absorption in imaginary situations, difficulty in reaching decisions, discouragement on slight provocations, looking for trouble, worry over trivial matters, sex perversion, excessive daydreaming, and lack of judgment. Persons so affected are likely to be very suggestible, impulsive, highly emotional, and selfish. They are unable to stand criticism and find it difficult to face the hard reality and annoying conflicts of life. It is probable that no one individual has all these characteristics.

The traits of a neurotic often show in apparently opposite direction and characteristics. Some authorities explain the predominant characteristics as compensation for the concealed inner state, probably a defense reaction; for example, a child who has a lack of self-assurance may show it not only in his timidity and his refusal to face facts but also in his apparently opposite characteristics, such as aggressiveness, extravagance, egotism, or self-assertion. Children and adults of this type may be easily hurt but pretend not to be. They may be readily suggestible but conceal the fact for the time being and act on the suggestion later. It is well for parents and teachers to recognize both the restrained and the unrestrained types of behavior.

CAUSES OF NERVOUSNESS

The most important general factors that predispose to a neurotic disposition are these: heredity, malfunctioning of the endocrine glands, education, occupation, and general

environmental surroundings. From the partial list given here, it can be seen how many predisposing and immediate causes for nervousness there are: (1) a hereditary, or native, tendency to a neurotic constitution; (2) too close association with antipathetic and neurasthenic personalities, whether parents, sisters, brothers, nurses, teachers, or playmates; (3) unsatisfied desires and thwarted impulses; (4) the existence of complexes or mental conflicts caused by narrow repressions, false modesty, improper sex education, and lack of confidence in adult advisers; (5) the habit of debating with oneself without reaching a decision; (6) failure to get the proper amount and kind of rest and recreation; (7) exaggeration of self-importance; (8) attempt to carry other people's responsibilities when it is not one's business or duty to do so; fretting over other people's conduct, ways, beliefs, and business; (9) an occupation where the work is monotonous, uninteresting, distasteful, and which gives rise to much thought after hours in the way of worry, anxiety, vexation, grief, and fear; (10) lack of suitable work; (11) prolonged morbid emotional excitement; (12) emotional infantile experience; (13) trying to compete with others in work for which one is not qualified; (14) malnutrition; anæmia; chemical poisons produced by infections, poor digestion, and glandular disorders; (15) eyestrain; (16) failure to mingle sufficiently with normal people; (17) short and broken hours of sleep; (18) injury to tissues by surgical operations, burns, or drugs; (19) poor working conditions, such as bad ventilation, poor illumination, lack of sunlight; (20) some form of organic inferiority, physical weakness, deformity, or disfigurement; (21) continued failures in some undertaking, which result in an inferiority complex.

EMOTIONALITY

Individuals who have trouble in adjusting themselves to their environment and to themselves have difficulty in developing the right attitude and the right emotion. It is not easy to distinguish the neurotic, or nervously unstable, from the extreme case of general emotionality. Extreme emotionality may represent only an excessive response to certain types of stimuli. Emotional susceptibility may predispose one to unhappy or unfortunate adjustments which in turn may exaggerate the emotionality. An emotion should be looked upon as an actively energizing state of consciousness. This state arises from bodily changes and is always expressed in certain bodily movements and attitudes.

There are all degrees of emotionality, ranging from the normal, or stable-minded, types to the emotionally unstable types. The stable-minded individual can readily adapt himself to social groups; the unstable, or highly emotional, is more or less of a misfit. The latter is very sensitive to what people say or think about him. He is often characterized by a lack of persistence, a changing of opinion, and unhappiness. He finds it difficult to make decisions and equally difficult to abide by them after they have been made. There is need of a balance between too little and too much emotion.

Our emotions aid us in our learning. Ideas should be connected with expansive, pleasurable emotions if they are to be remembered, and the business of education is to develop and direct the emotions. The teacher's business is to associate with the correct emotion that which she tries to teach. Anything learned that is associated with unpleasant emotions is readily forgotten, and all things which are connected with pleasurable emotions are remembered for a longer period of time.

COMMON TYPES OF MENTAL ADJUSTMENTS

Human impulses, instinctive tendencies, and desires are constantly being thwarted or blocked in numerous ways. There may be a conflict between the instinctive tendencies or desires. Native reactions may be thwarted by one's early training, experiences, habits, ideals and attitudes, social convictions, and customs. Circumstances, such as war, poverty, depression, illness, famine, and pestilence, are frequently responsible for the thwarting of tendencies that would otherwise find expression. A feeling of inferiority or some form of organic handicap, such as is often found in cripples, may thwart strong native tendencies and thus affect behavior.

In the course of the individual's attempt to adjust himself or to satisfy his thwarted tendencies or desires, many reactions are made in a more or less trial-and-success fashion. When an adjustment has been found which brings satisfaction, it tends to become fixed as a habit. The responses made may become substitute responses. The diverting of thwarted impulses and energies into harmless and useful activities is known as substitution. Some of the substitute responses are readily observable; others are less easily detected, either by the individual making the responses or by an observer. The two main classes of adjustments of this sort are the introvert responses and the rationalizing, or self-justifying, responses. All life is a matter of adjustments, — adjustments within the individual, adjustments between individuals, and adjustments between the individual and society; all of these are essential to success and happiness. In the physical world an automobile that is out of adjustment cannot function properly. In the mental world, if we are out of adjustment, we do not work harmoniously with others. The right amount of

emotion at the right time, in the right relationship, and pointed in the right direction results in desirable activities. The direction our emotions and attitudes take is the important factor in determining our success or failure.

Conflicts between ideas and emotions result in maladjustments. Education should secure proper, wholesome, desirable adjustments between the individual and his environment. Mental health means mental adjustment. Mental disorders are indications of maladjustment.

INTROVERSION AND EXTROVERSION

The introvert is an individual who is self-centered, one whose interests turn inward. He represents the "shut-in" type of personality, who is concerned only with himself and his own intellectual and emotional world. He finds a great deal of satisfaction in his own mental activities. The extrovert lives in and for the objective world. His interests turn outward. His greatest satisfaction comes from display or from aiding and helping others. Unlike the introvert, who is absorbed in his own mental processes, the extrovert is concerned with practical affairs; the introvert, by cutting himself off more or less from the outside world, may become a great scholar or thinker if he has both the ability and the purpose. Without proper stimulation and guidance, the child who is of the introvert type may be confined to worlds of his own images, ideas, and feelings, completely divorced from reality. The proper development of the individual implies a certain balance between introversion and extroversion. The extrovert can be taught to reflect, and the introvert can be encouraged to think of things and people and not to fear contact with others.

A form of introversion in which the dreamer is the hero has been called the conquering-hero tendency. The instinct-

tive desire for mastery and self-assertion is usually the tendency which is satisfied. Introversion in some form or other is a normal and universal experience.

The suffering-martyr tendency is another type of adjustment. Like the conquering-hero tendency, it is a form of self-assertion. These forms, like many other adjustments to thwarted tendencies, are indulged in by normal people. They differ only in degree from the delusions of grandeur and persecution found in certain forms of insanity or extreme cases of mental illness.

Identification is a form of mental adjustment which is very common. In this form of mental adjustment the individual gains satisfaction for a native tendency by identifying himself with some character on the screen, or on the stage, or in pictures, or in actual life situations. In life the child is constantly identifying himself with someone he admires and likes. The possibility of some identification, and its importance in education, can scarcely be overestimated. Examples of identification can be seen in every walk of life. Most children follow the politics and religion of their parents without really giving the subject a great deal of thought. The mechanism of identification is very important in life. Identification helps us to feel benefited whenever we have done a kindly act. It is an important factor in success or failure.

Rationalization is a form of self-justification. It differs from reasoning in that only those facts and factors are selected which tend to prove what one wants to prove or believe, and which promise a satisfying conclusion. Rationalization is so common in everyday life that it may interfere seriously with scientific thinking and social progress. The so-called logic-tight-compartment tendency is a form of rationalization in which the individual is impervious to facts which do not conform to his own pre-

conception and in which his reactions are predetermined by mind sets. Occasionally, in rationalizing, one makes some other individual responsible for his action. He blames others for his shortcomings. This form of reaction may be designated as a projection tendency. It may take the form of expecting criticism and reproaches from others. If it recedes so far that the individual imagines an accusing finger pointed at him or if he hears accusing voices, his reactions are abnormal and may possibly indicate some characteristic of insanity. There is no sharp line of demarcation between the sane and the insane or between the normal and the abnormal.

Another interesting form of reaction is the "sour-grapes tendency," seen in the individual who takes the attitude that that which he does not possess and cannot get is not worth having. The converse of this tendency is the Pollyanna tendency, in which the individual takes the attitude that whatever is, is best. This form of reaction forces a kind of self-deception and a tendency to evade facts. It is often manifested in what is known as a defense reaction.

DISSOCIATION

Students of nervous and mental disorders find many types of dissociation. The consciousness of personality in each individual is normally continuous and consistent from day to day. In certain situations the individual may use one set of reaction patterns, and in other situations use others. Occasionally changes are so striking as to attract attention. These disturbances range from fleeting illusions to insanity. Pronounced mental abnormalities of this type are called dissociation.

In cases of dissociation of the personality the continuity of thought and action is broken. A person who is dominated

at certain times by one set of purposes and ideals will at another time be dominated by other purposes and ideals. An individual may suddenly lose all memory of his past life, forget his name, his home, his friends, and start anew with another name, a new occupation, a new set of purposes. The individual may have been honest, cheerful, industrious, and sincere; he may now be unreliable, lazy, pessimistic, or dishonest. Later he may revert to his former personality and thus recover all the memories of his former self, but he will not have any recollection of his second personality, his characteristics, and the happenings that occurred during the period of his altered condition. In some cases, the individual may have three or four distinct personalities, each of which usually is totally unknown to the others. Sometimes these alternating states may be separated by a period of unconsciousness, and, again, the change might be quite sudden.

These alternating states should be a warning to those who are likely to think their own personal type is the only type. One should be reminded also of the fact that in everyday life there are occasionally suggestions of the ease with which certain dissociative reactions may be set up. Many a man or woman in the cloister of the home is a totally different person from the one who is known to the club or to business associates, and each personality is consistently maintained.

The exact cause of alternating personality is not clear. It is pretty well agreed that the disturbance is a functional disorder involving the reorganization or formation of neural patterns. An individual suffering from the organization of a large number of independent neural patterns which result in dissociation and multiple personality will be a disturbing factor, not only to himself but to his friends, and will ex-

perience a decrease in efficiency. This type of individual lacks stability, and needs help to achieve reorganization into a permanent and stable personality.

THE FEELING OF INFERIORITY

The feeling of inferiority is the result of ideas or sets of ideas bound together emotionally in such a way as to make us feel inferior to or less able than our fellows. We may be aware of our individual limitation, we may recognize it faintly, or we may be totally unconscious of it; but it will express itself in our everyday behavior.

Failure to meet the success which we anticipated, disappointment in someone or in our love life, a defeat in a complex situation, or a feeling of infirmity from a physical point of view may lead to an inferiority complex. A feeling of inferiority may arise from a physical disturbance, from an environmental or a mental state, or from a combination of any of these.

Who is there that does not hate to be neglected, to remain without the affection of someone, to be pushed to one side, or to be given a lowly place in the world? We all want to succeed, to master difficulties, to feel strong and equal to others. The feeling of security comes as a result of successful achievements, while failure may result in a feeling of insecurity.

A feeling of inferiority is symptomatic of certain types of unbalanced personality. It is characterized by a false evaluation of one's ability. This feeling may have its origin in one or many experiences. A child who is constantly undervalued, whose questions, opinions, or remarks are always laughed at or spurned, and whose efforts are invariably criticized rather than praised, is robbed of an adequate basis for self-confidence or feeling of self-respect.

Such treatment deprives the child of the satisfaction that comes with success or accomplishment. These results are always greatly exaggerated in the case of the sensitive child. Physical handicaps of all kinds likewise subject the child to unkind remarks, gestures, and teasing; consequently, he is forced to recognize his inadequacy to cope with other children more favored by nature or circumstances.

The feeling of inferiority is one of the most common of neurotic symptoms and traits of character. In most neurotics this feeling leads to a deep sense of inadequacy and self-depreciation, not warranted by the facts. Such a feeling of inferiority inhibits effort and causes much dissatisfaction and unhappiness as well as many failures. Opportunities for success should be provided for the child; responsibilities should be given him. His efforts should be treated with confidence, respect, and wholesome consideration. Neither too little nor too much emphasis should be placed on any tendency. If called to the attention of the child too frequently or too strongly, the tendency may be exaggerated.

Not infrequently, the disabilities, imaginary or real, which give rise to the feeling of inferiority are believed to be compensated for. The individual attempts to make good the inferiority by extra exertion of some other kind. One pattern of mental activity may be compensatively substituted for another. For example, a student in answering questions in class may compensate for his lack of facts by an increased volume of words or by speaking in a louder tone, or a servant dominated throughout the day by his employer may compensate for this submissiveness by ruling his wife and children in a domineering way.

Many of the failures in life come as a result of the feeling of inferiority, the inability to meet situations. The educational world has put forth a great deal of effort to reduce the number of failures in the various fields of human en-

deavor. Failures are not necessary, but most failures can be traced to some disturbed emotion. The feeling of inferiority is an emotion. Fear is man's greatest enemy to success. Fear is a part of our native equipment, and it should be guided and directed rightly. Fear lives and thrives in its native element, and its source is a sense and feeling of inferiority or inability to cope with life, dread of being vanquished and outdone, a sense of limitation and of inability to achieve the fullest success and happiness. Every individual suffers from fear. Some fears are good and wholesome; some are necessary for an individual's own protection; but the inferiority-fear complex is at the root of most of our troubles and failures. If stimulated, the fear complex may be woven into the nerve patterns of every individual. We may suffer because of these nerve patterns or profit by them, depending upon the direction the fear complex takes.

Fear is a very real thing in the life of an individual. It is appealed to by both teachers and preachers as well as by parents. It develops early in the life of a child and is difficult to eliminate. Fear is all right if it is in the right amount and comes at the right time. Fear at the wrong time is a serious and apparently universal inhibition. Fear interferes with so much of human happiness and efficiency that it should be studied and understood by all teachers and parents. There are some fears and emotional states that are so deeply rooted that nothing can afford a release, so far as we know at the present time. Most patients of our state institutions for those who are mentally ill have abnormal fears.

The feeling of inferiority does not necessarily mean that the individual will be a failure and that no success can be expected of him. It may work to his advantage. If this feeling of inferiority is well compensated for, it may be a

stimulus to success, to adjustment, and to happiness. It is necessary to understand this feeling of inferiority before one can guide and direct it rightly. Many of the feelings of inferiority have deep-seated causes, and it takes considerable pains and psychotherapeutic help to analyze the causes and to remove them so that the individual may proceed in a normal way. Wherever there is a feeling of inferiority, there is always an attempt to compensate for it. A reorganization of one's thinking and acting must take place before one can overcome the feeling of inferiority. A feeling of inferiority may be eliminated through a series of successes. One success is not sufficient; the series must be continuous over a long period of time.

IMPORTANCE OF INFANTILE EXPERIENCES

Emotional traits are as significant for success and happiness as is mental ability. Prompt recognition, understanding, and treatment of neurotic tendencies in early childhood will do much to decrease the incidence of mental disturbances and unhappiness in the later life of the individual. No child should be allowed to fail; he should be given every opportunity to succeed. Confusion and mental conflict should give way to definite tasks and clear instruction. The development of wholesome habits of work is a safeguard of health, sanity, and morals.

PSYCHOGENIC EPIDEMIC

History abounds with cases of psychogenic epidemic. Many instances have been reported where disorders of children have spread by imitation and suggestion. In the Middle Ages such epidemics were principally of a religious origin. The frequency of imitative epidemics today is greater than is generally believed. In 1893 such an epidemic

was reported in a girls' school at Stuttgart. After a girl had fainted, twenty-five cases of nervous disturbances occurred. At Budapest, in 1895, an unusual cough spread through a girls' institution. The number of such psychogenic epidemics is too great for the phenomenon to be denied. Certain nervous symptoms, if allowed to go unchecked in our schools, may spread by psychic contagion, or imitation, to many of the children.

SPECIFIC NERVOUS AND MENTAL DEFECTS

Mild forms of nervous defects may be noted in an abnormality in speech. Now and then such an abnormality as lisping is caused by an actual malformation of the speech organs, but usually such defects are of nervous origin. About one child in forty has a speech defect of some kind; lisping, stammering, and stuttering are the chief varieties. These are most common between the ages of seven and sixteen, and their importance is augmented by the fact that normal children often imitate defective speech with great readiness. Headache, which may be caused by visual strain, bad teeth, adenoids, or indigestion, is, when not associated with any of these, often a sign of a nervous ailment. Headache is a symptom, not an ailment by itself. It may be caused in many different ways and may need many different procedures for its cure. Tics, or spasms, of an isolated muscle or group of muscles, are unusual except in certain nervous diseases of which they are symptoms.

CHOREA

Chorea, also known as St. Vitus's dance, occurs in one child in about every hundred, girls being more frequently affected than boys. Chorea is only a symptom denoting involuntary, irregular, purposeless muscular contraction.

A patient has twitching of the face or head or limbs which cannot be controlled, sleeps poorly, has frequent nightmares, and is both peevish and changeable in disposition. The disease, which is rarely found in children below eight years of age or above fifteen, may last from six weeks to three months. Chorea constitutes about 20 per cent of all nervous diseases in children. Children suffering from this disease need a great deal of care and patience in handling.

NERVOUS INSTABILITY

Some persons are born with nervous systems that are very easily deranged; others acquire nervous instability through bad habits and incorrect living. What is meant here is the nervous child who is "perfectly well" but who is very easily irritated and disturbed. It is possible to correct this condition through the formation of desirable attitudes. The cause of the irritation should be removed and the child's physical condition built up, and this can be done only through proper food and rest. In the schoolroom as in the home there are many conditions which may irritate the nervous child. A teacher's voice may not be too loud or too harsh for most children, and yet be almost maddening to the nervous child. In such a situation the child should be changed to another teacher and another environment wherever possible. In this way he can be removed from the cause for his nervousness. Occasionally a nervous child who is easily frightened is repressed by the school and forms an inferiority complex which may result in failure.

FORMS OF DEMENTIA

Dementia denotes a marked mental dissociation or deterioration, often owing to atrophy of the cortex of the brain. When the behavior of an individual becomes such as to indicate persistently abnormal thinking, he is called

mentally ill or, in extreme cases, demented. Mental illness is just as serious as any physical illness, and a defect or disease in the thinking needs just as much care as any physical disturbance. Individuals who are considered demented are mentally ill. Every case of dementia is a mental and physical disease. A person who has been intelligent and who develops defects in his intelligence and his thinking is usually suffering from what we generally call dementia. There is a decided loss of memory for recent events and occasionally for distant ones. There is impaired judgment, general failure of mental power, and loss of ability to see relationships. The patient loses interest in the world about him and in most instances shows no emotion. A person suffering from dementia neglects his body and fails to keep clean. There may also be a loss of desire for food and for companionship.

Dementia præcox. The mental disease which is found in approximately 60 per cent of all cases which appear before the age of twenty-five is known as dementia præcox. This is a form of psychosis beginning in early life and is characterized by unsociability, a "shut-in" type of personality. There is a progressive enfeeblement of the mind. The form of dementia præcox which appears at about the age of puberty or later is called hebephrenia. A patient suffering from this type of mental disease suddenly becomes quarrelsome, irritable, profane, and frequently attempts to run away from home. He becomes suspicious of his parents and friends, imagining them to be working against him, and his actions become increasingly childish. This disease causes mental deterioration. The early symptoms of hebephrenia resemble those of neurasthenia. Patients take on many abnormal forms of behavior. Some may become solitary, brooding, quiet, and indifferent to people. Others may have delusions of grandeur, feeling and thinking that

they are worth enormous amounts of money or have great strength and power. There is another group who show spontaneous outbursts of laughter without any apparent cause; they hear voices, someone is talking to them, and this amuses them very much. As the disease progresses there comes emotional indifference; the power of decision disappears more and more. This form of mental illness, which is found mostly in adolescent youth, needs a great deal of study and investigation. Perhaps, through different kinds of work, different management, different environment, cases of this type might be prevented from developing.

Another form of dementia præcox is known as catatonia, or the catatonic form of dementia præcox. This is usually found in older patients, especially among women after child-bearing. During this period of the catatonic stupor, from which it is difficult to arouse them, they probably hear everything going on around them. They may suddenly wake up and come out of the stupor as though they were coming out of a sleep. This catatonic stupor may alternate with catatonic excitement. During the period when they are not in a catatonic stupor or excitement they are very suggestible; they suffer from echolalia, echopraxia, and what is known as a waxy flexibility. Together with this, they often have the delusion of persecution. It is believed by some that this catatonic state is brought about by focal infection and that when this is removed the patient becomes normal again. This is a form of dementia præcox for which the medical profession holds some hope of recovery.

The third form of dementia præcox is known as the paranoid form. This form of mental illness usually develops in later adolescence or in early maturity. After many years of this, during which the patient may have been confined to prevent him from harming others in obedience to his delusions, the mind deteriorates. In this type of mental

illness there is a very rapidly progressing mental weakness. However, there is a preservation of certain ideas and forms of lucidity. In this form we see chronic delusions and hallucinatory states in contrast to the fleeting and transitory delusions and hallucinations of the other two forms of dementia præcox. In the paranoid form of dementia præcox these delusions are pronounced and progressive. There may be delusions of grandeur; often an individual thinks himself a second Napoleon or a new Moses. In time, however, deterioration takes place, and the individual becomes mentally like an imbecile. It is believed that approximately one tenth of the cases of hebephrenia and catatonia recover, but no cases of the paranoid form have yet been known to do so.

Paranoia. Another form of mental illness, more mysterious perhaps than any other, is known as paranoia. It is a constitutional mental disorder which is characterized by the development of a systematized delusional trend. There is no evidence of deterioration of the individual's mental power, and by some it has been called the reasoning insanity. It has been said that heredity plays a greater part in this form of insanity than in any other. In this relatively uncommon form of psychosis the essential feature is a fixed idea, delusional in nature, which forms the basis for the mental disturbance. There is a progressive development of this idea; it seems possible and logical, and in most cases is coherent, but there is a false interpretation and a delusion. Individuals suffering from this form of mental illness have more or less fixed and systematized delusions. They suffer more from delusions than from hallucinations. They become "eccentric" individuals. The emotional tone and the reaction of patients suffering from this disturbance are in harmony with the delusional system. They also have ideas of grandeur. The system of ideation is so coherent that

many individuals suffering from this form of mental illness are not detected. They are among the rare cases found in institutions for the mentally ill.

General paresis. Mental disorders due to physiological or organic disturbances can be called general paresis. Paresis, coming under the head of general paralysis of the insane, is caused by syphilis. Approximately 10 per cent of the cases seen in the state hospitals for mental diseases are of this type. This disorder is from four to six times as frequent in men as in women. General paresis does not take place in all cases of syphilis; but in the cases where it is manifested, it appears from five to forty years after the original infection, the majority of cases occurring from eight to twelve years after syphilis was acquired. It is usually seen in patients who are in the prime of life, between the ages of thirty-five and fifty years of age. Paresis, or general paralysis, is a chronic disease of the brain characterized by degeneration of the neurones of the cortical area. This is marked by the progressive loss of mental and physical power. An individual who is suffering from general paresis is irritable and fretful, changes in his character, loses interest in his affairs, wants to concentrate but cannot, has exceedingly poor judgment, may make very foolish purchases, and manifests a lack of moral control. These are the first evidences we observe. A little later the patient reaches a state of mental exaltation — he is very happy, cheerful, confident, and has abounding euphoria. Still later there is a systematized delusion of grandeur. He talks a great deal and develops great schemes for inventions or for the acquisition of great wealth. A little later he forgets recent events, his memory deteriorates, and he now becomes quiet, cannot recognize intimate friends, neglects personal hygiene, becomes disorientated in time and place. Proper care and early treatment by malaria or some other one of the recent

treatments for the control of the spirochæte of syphilis may prevent serious dementia.

Manic depressive psychoses. This group of psychoses is characterized by mental disorders in which the disturbances are mainly of the emotional type. They are characterized by attacks of excitement or depression, or a mixture of both. Each attack terminates in recovery but leaves behind a tendency toward recurrence. There is evidence of a tendency toward recovery without any mental deterioration. This type of mania has three principal forms: namely, simple mania, delusional mania, and confused mania. There is flight of ideas, irritability, morbidity, euphoria, impulsive character of the reaction, and considerable motor excitement. The possibility of recovery from this type of disturbance is very good provided there is sufficient rest and quiet. Duration of time between attacks may lengthen, and possibly they may disappear entirely. People who are susceptible to this kind of mental disturbance are emotionally unstable and excitable. School-teachers often exercise an unfavorable influence over such children and stimulate them to a manic depressive type of behavior.

EPILEPSY

Epilepsy is an organic or functional psychosis, often hereditary or a result of some glandular or traumatic disturbance. Science has developed no cure for this disease, and no true cause is known. The earlier it appears, the greater is the accompanying retardation in the growth of the intelligence. Epileptic persons vary greatly in the frequency and strength of their seizures. Other mental diseases often accompany this disorder. In some states they have what is known as the epileptic colony or a special institution to take care of people suffering from this affliction. It would be

well if children afflicted could be taught in special classes. The one important point to be borne in mind with regard to all epileptics is that mental deterioration is characteristic of all cases, especially those of long standing. Deterioration is particularly marked in those cases accompanied by a psychosis. These children become duller and duller; what they learn at one time is forgotten a few hours later, and after some years they closely resemble feeble-minded children. Aside from the tendency to deterioration, the epileptic becomes a peculiar type of personality. He becomes exceedingly irritable; he is characterized by marked egotism, and in some cases he is overreligious. He has a tendency to dream and sometimes has hallucinatory experiences. Some epileptics become very pugnacious and may become dangerous. This is one of the reasons why they should be committed to an institution equipped to take care of them.

HYSTERIA

In hysteria the symptoms of almost every other bodily affliction may be imitated. It is a psychomotor neurosis in which the morbid mental state is not sufficiently pronounced to require institutional care. The line between great nervous instability and actual hysteria is hard to draw. The hysterical patient is extremely suggestible and very unstable in emotions. He may develop areas of anæsthesia in which the functionally perfect sense organs apparently do not give rise to nerve impulses to the brain. There are many other symptoms. All symptoms are of psychogenic origin. In hysteria the patient's reactions are often due to maladaptation, showing a simple physical symptom such as paralysis, aphonia, deafness, or convulsion. The symptoms referable to the functioning of the sensorimotor system are more complex conditions, such as deliria and fugues.

Hysteria is not yet known to be associated with any structural changes in the brain; the fact that recovery is often complete would indicate this. It is a disorder of functioning, and is often very difficult to diagnose. After the age of ten it is much more frequently found in girls than in boys. Some authorities claim that hysterical symptoms serve as a mental defense against some painful experience which is repressed mentally, its arousal causing hysterical seizure. These disagreeable experiences usually have occurred in early childhood. In many nervous disturbances any method that directs the patient's attention to his own woes and ailments is harmful, but hysteria may often be cured if the cause is brought to the attention of the patient.

BASIC PRINCIPLES OF MENTAL HYGIENE

Dr. William H. Burnham gives us the minimal essential conditions of human happiness reduced to their lowest terms. His three essentials apply equally well for all — young and old, rich and poor, the healthy and the diseased. These are not mere guesses or opinions. They are founded on observations and many investigations.

The essentials, without which a person cannot be quite sound mentally and with which, apart from accident, infection, or heredity, one can have no serious mental disorder, the absolutely essential conditions are three: a task, a plan, and freedom.

The task in the generic sense includes everything from the immediate and concrete goal of the moment to the objectification of the highest ideals and ends. A plan is necessary to make the work purposive activity. It must be my own task, hence, freedom is necessary. . . .

A score, perhaps, of recent books in education — in this country, books emphasizing the project method and motivation, in England, books emphasizing purposeful activity and the problem attitude — may be summed up in the words: task, plan, and

freedom, and what is involved in them; so that the clear understanding of these fundamental conditions and what they mean for the mental health is more important for the teacher than superficial reading of many books on principles and methods, and worth more than a mere knowledge of all the mental tests, standard scales, and all devices for increasing and measuring the scholastic product, because without this one does not see the meaning of the tests and scales. With this, on the one hand, one sees the real value of methods, tests, and devices, and is able to keep clear a vision in the field of practical education and hygiene. . .

These three essentials of mental hygiene and of education for the individual represent also the fundamentals in industry.¹

In the treatment of nervous children the following cautions should be observed :

1. Remove all irritating causes, such as adenoids and bad teeth, and correct malnutrition, indigestion, anæmia, and other physical defects.
2. Treat all children as individuals, not as a class or a group.
3. Set up situations which will cause the child to forget his condition, and at the proper time suggest that he is better.
4. Cultivate in the child a keen sense of humor. It may be his saving grace. Build up in him an optimistic view of life.
5. Make the child, within reasonable limits, struggle for himself.
6. Replace unhygienic habits by quiet rest, plenty of good, wholesome food, and outdoor life. The child needs abundant, undisturbed sleep.
7. Habituate the child to courageous acts and prevent fears by a quiet reassurance and a reasoned, sympathetic

¹ William H. Burnham, *The Normal Mind: An Introduction to Mental Hygiene and the Hygiene of School Instruction*, pp. 207-208, 210-211, 213. D. Appleton and Company, 1924.

investigation. Habituate him to brave moral acts, such as facing painful consequences of conduct, accepting failure or blame at face value, deciding about problems rather than evading the issue, and facing difficulties promptly. This may prevent repressed emotional complexes.

8. Train children to attend to the present and to ignore the past and the future except as they are related to the present. This means avoidance of worry. Worry over grades and promotions is not conducive to mental poise.

9. Provide opportunities for social intercourse with other children, especially in free play. Nervous children need to mingle with healthy children. Here is a chance for the child to express himself. Children should also be given this opportunity in classroom and at home. Mental stress and strain begin where one's work is not the expression of his desires but is in conflict with them. The person who withdraws himself from others develops a shut-in self. He seeks to satisfy it in an imaginary world. He becomes oversensitive, shy, and inefficient. The cultivation of normal social relationships should be encouraged. To feel isolated and different from other people and to blame others always for one's own failures is a serious situation, either for the child or for the adult.

10. Establish impartial adult control, neither vacillating nor strict, which shall train to self-control. This involves training children to take effective action when necessary. The home and the school need to provide opportunities for development of initiative and leadership. Repression of action means nervous strain. To do something effective in meeting a crisis reduces strain and worry. A desirable kind of training is exemplified by training children to act promptly in administering first aid to the injured or in preventing accident. Great emotional excitement often accompanies inability to meet difficulties.

11. Train the child to confide in parent or adviser, rather than to repress thought. Dr. Healy, in his studies of delinquency, has frequently found that mental conflicts and repressions often give rise to delinquency and in many cases to a neurotic condition.

12. Supply the child with work which is interesting and adapted to his ability and which will occupy his attention and favor further development. That is to say, we are to train the child to succeed. Training the child to a sense of personal worth is essential for his happiness and mental health.

13. Working at a thing which the child likes to do is much better for the mental health than engaging in a task, trade, or vocation that is distasteful. To be sure, we should aid the high-school child in deciding his life work, but we should not thrust upon him any vocation. Some people need work that entails little responsibility and that is relatively free from worry, frequent decisions, and thought "after hours." Other people prefer work that requires planning and the making of decisions. Everyone should do the work that he likes to do.

Some forms of mental disorder cannot be prevented by any of the ordinary educational methods, for they are the product of heredity, being organic in character. There is, however, a much larger group of children and adults, on the verge of a breakdown or suffering some degree of nervousness, who, with only a few exceptions, may be benefited and in many cases cured. To cure requires the best efforts of a highly trained specialist in the field of mental hygiene.

The integration of the physical, mental, spiritual, and emotional natures of man is the most important work education has to perform. We should use the emotions effectively through superior guidance and understanding. We must direct the emotions in such a way that they will

develop a drive, an inner urge, along the channel which leads to activities which are uplifting and beneficial to the human race. A great deal more must be known about how to use this important factor of human life, and the proper relationships must be established between the emotional, the physical, and the intellectual aspects of behavior.

QUESTIONS AND EXERCISES

1. What is mental hygiene?
2. How prevalent are nervous and mental disorders?
3. What are the characteristics of a nervous child?
4. How may nervous children compensate for the concealed inner mental state?
5. Make a list of possible causes of nervousness.
6. Why is it imperative that teachers should know (1) how to recognize nervous symptoms and (2) how to treat such cases?
7. Give an illustration of the thwarting of an instinctive tendency.
8. How do introverts differ from extroverts?
9. What educational treatment would you prescribe for each of the different types of maladjustments?
10. What is meant by "dissociation"?
11. Think of some child who has a feeling of inferiority and tell what should be done with him.
12. What is dementia præcox? hysteria? St. Vitus's dance? tic? paranoia? chorea?
13. Comment on the following practices: (1) holding up a child to ridicule; (2) comparing one child with others in a classroom.
14. Define "rationalization." How do children learn to rationalize?
15. What is meant by "logic-tight compartment?"
16. Defend or criticize the following statements: (1) Never let a child fail completely. (2) Teachers should not betray the confidence of children.

17. Suggest ways of reconditioning a child who is afraid of lightning and thunder.

18. Name and discuss some practical suggestions for a mental-hygiene program.

19. Discuss each of the following suggestions:

a. Avoid corporal punishment with all nervous children.

b. Nervous children should never be teased, especially when they show some interest in the opposite sex.

c. Fairy stories and moving pictures concerned with killing and robbery should not be given to children.

d. The nervous child needs abundant undisturbed sleep.

e. Worry over grades and promotions is not conducive to mental poise.

f. The teacher's business is to see that "every child at some time, in some way, in some subject, achieves a success that will give him a decent respect for himself."

BIBLIOGRAPHY

AVERILL, L. A. *The Hygiene of Instruction*. Houghton Mifflin Company, Boston, 1928.

BAGBY, ENGLISH. *The Psychology of Personality*. Henry Holt and Company, New York, 1928.

BURNHAM, W. H. *The Normal Mind: An Introduction to Mental Hygiene and the Hygiene of School Instruction*. D. Appleton and Company, New York, 1924.

BURNHAM, W. H. *The Wholesome Personality*. D. Appleton & Company, New York, 1932.

DUNLAP, KNIGHT. *Social Psychology*, Chap. II. Williams & Wilkins Company, Baltimore, 1925.

FOLSOM, J. K. *Social Psychology*. Harper & Brothers, New York, 1931.

GROVES, E. R., and BLANCHARD, P. *Introduction to Mental Hygiene*. Henry Holt and Company, New York, 1930.

HEALY, WILLIAM. *Mental Conflicts and Misconduct*. Little, Brown & Company, Boston, 1917.

HOLLINGWORTH, H. L. *The Psychology of Functional Neuroses*. D. Appleton and Company, New York, 1922.

MATEER, F. *The Unstable Child*. D. Appleton and Company, New York, 1932.

MENNINGER, K. A. *The Human Mind*. Alfred A. Knopf, New York, 1930.

- MORGAN, J. J. B. *Psychology of the Unadjusted School Child*. The Macmillan Company, New York, 1924.
- MORGAN, J. J. B. *The Psychology of Abnormal People*. Longmans, Green & Co., New York, 1928.
- PRESSEY, S. L., and PRESSEY, L. C. *Mental Abnormality and Deficiency*. The Macmillan Company, New York, 1926.
- ROBACK, A. A., Editor. *Problems of Personality*. Harcourt, Brace and Company, New York, 1931.
- ROSANOFF, A. J. *Manual of Psychiatry* (Sixth Edition). John Wiley & Sons, New York, 1927.
- SADLER, W. B. *The Mind at Mischief*. Funk & Wagnalls Company, New York, 1929.
- SADLER, W. B. *Piloting Modern Youth*. Funk & Wagnalls Company, New York, 1931.
- WECHSLER, I. S. *The Neuroses*. W. B. Saunders Company, Philadelphia, 1929.
- WILLIAMS, FRANKWOOD E. *Adolescence Studies in Mental Hygiene*. Yale University Press, New Haven, 1930.
- WILLIAMS, FRANKWOOD, and others. *Social Aspects of Mental Hygiene*. Yale University Press, New Haven, 1925.
- ZACHRY, C. B. *Personality Adjustments of School Children*. Charles Scribner's Sons, New York, 1928.

CHAPTER XXI

PSYCHOLOGY IN SCHOOL RELATIONSHIPS

Educational psychology, for the past quarter of a century, has been dealing primarily with the problems of learning in their individual relationships. Today, because of its large place in education, it must include the relationships involved in the individual's development and learning, in social contacts, in governmental and administrative aspects of human life, and in the hygienic conditions involved in proper and normal development.

Human relationships are as broad as life and touch every form of human reaction. Every social adjustment is an individual reaction in relation to social stimulation. Psychology is the basic subject for all the human sciences where thinking, feeling, and acting are involved. Learning is vitally more than lessons or assignments. Learning is the result of any contact. Every contact stimulates some activity, and this may result in learning. Constant adjustment is taking place within an individual, and adaptation must take place to changing external conditions.

This text is primarily concerned with teacher-pupil relationships, especially as these are developed in teaching and learning situations. However, it is recognized that many aspects of a teacher's work are related to some broader contact, such as are found in administrative and advisory control and in associations with the general public. The teacher should realize that the principles of psychology are applicable in all situations of this nature.

Many who are studying educational psychology are either

serving schools in administrative or supervisory capacities, or are destined to do so in the near or remote future. They are also working with children who will come in contact with other relationships than those found in the classroom. It would be most unfortunate if they were to conceive of the subject of educational psychology as one which refers only to classroom procedures and to the guidance of the pupil in the various learning situations.

It is evident that psychological consideration should govern in all personnel relationships of school work. Only when this is done can the school attain its greatest efficiency. In many cases there is a tremendous waste of human energy, and in some, critical conflicts develop because of the failure to apply the fundamental principles of human psychology. The attitude of educational leaders and of the public is as significant for successful work as is the attitude of the pupils in the classroom. Learning and adaptation are as important for these leaders in their various fields of activity as for the children who are engaged in studying particular subjects.

Need for sympathetic understanding. For the efficient operation of a school system it is essential that the morale of the educational workers be established and maintained. This morale is dependent upon the extent to which each one has an appreciation of the work and aims of others. Coöperation can be fully assured only when each worker conceives of his task as one unit of the whole rather than an isolated activity and sees how it is related with the work of others in achieving the desired goal. When thus considered, one's labors take on an added significance. Critical and antagonistic attitudes cannot thrive in such a situation.

Teachers need a type of training which will lead them to view their work with a broad vision. They will thus be enabled to understand their work in relation to the com-

munity and will respond readily to the public demand. They will be able to sense the public pulse and desires. They will realize the requirements and responsibilities placed upon the administrative officers of a school system and appreciate the necessity and advisability of specific requests and programs. They will have some comprehension of the way in which the school system is supported, organized, and controlled for effective work.

Supervisors are primarily members of the instructional staff of a school system. Training in the work of teaching and valuable experience in the teaching field are essential as a basis of real understanding of the supervisors' tasks. The supervisor whose training and experience is inadequate as compared with that of teachers under his or her charge has a handicap which is difficult to overcome. The supervisor is one who guides and trains and helps the teacher, and in order to do this well she must acquire a knowledge of those psychological principles which dictate the best methods of instruction. To illustrate this point, the supervisor, upon visiting a room, should see whether the children are in a state of readiness to learn and whether the teacher is in a state of readiness to teach. She must observe whether there is a desirable rapport between teacher and pupil. This would be following the psychology set forth in the laws of learning. The psychology of giving assistance to a teacher by a supervisor is as important for the supervisor as a knowledge of the fundamental principles of human reaction in learning situations.

The supervisor is not only expected to be an expert teacher and a guide of teachers. She is also called upon to act as an intermediate agent between the administrative office and the teacher. In addition to understanding the psychology of human behavior and the emotional reaction of teachers in the varying situations and conditions in which

she finds them, the supervisor must have an adequate understanding of the work of the superintendent; she cannot successfully represent the work of the superintendent to the teachers or give a full service to the school or community unless she has a realization of the important position and work of those who guide the destiny of a school system. In preparation for this function as assistant superintendent, the supervisor needs training in administrative work as well as in supervision proper.

In the same way the superintendent of schools in particular, and his immediate administrative staff in general, can succeed fully only to the degree that they are cognizant of the specific duties and the intricate problems of the teaching staff. Valuable though educational theory may be in certain situations, the superintendent and his administrative staff must be intensely practical. He who has reached his position after rich experience in teaching and supervision has a better appreciation of the practical needs and issues than he who has merely an academic training. A primary responsibility of the administrative officer is that of securing the whole-hearted coöperation of all under his direction. This can be done only when there is a sympathetic understanding of the problems of the teaching force and the public demand.

The need for definite objectives. Psychology teaches us that we are all working toward some distant end, some objective. In the administration of a school system the board of education is the policy-forming body. The superintendent may offer suggestions and ordinarily has a voice in determining the general and specific objectives. As an advisor of the board he is often the most fruitful source of authoritative information upon which policy may be based. In any event, he should know the psychology which is necessary to stimulate the board in fixing such policy as

well as in revising it constantly in the light of the changing needs of our progressive age. No school system can attain any degree of success and render service without some definite policy and some definite objectives toward which it is working.

The work of every officer and teacher in a school system should be directed toward definite and attainable objectives. These objectives must, of necessity, be in harmony with the general policy and delimited by it. But, even so, there is an abundance of room for originality and initiative. No generalized statement of objectives can be realized except as many detailed goals are set up and reached. A very important part of the work of the school administrator and his staff is that of analyzing the general policy in the light of the entire situation and stating very definitely and concretely those objectives to which all the individuals or groups of individuals concerned should direct their effort.

Just as the teacher conducts the recitation period according to formulated recitation plans and directs the activities of pupils toward a specific objective for the class as a whole, as well as for each pupil, so the principal or supervisor may direct his observation of teachers to certain definite aspects of instruction and advise the teachers according to their specific needs. Unless there is a particular objective at any one time, the guidance is likely to become random and relatively fruitless.

More than one goal may be sought coincidentally. In undertaking a newly formulated objective, it need not be implied that former ones are automatically discarded or completely neglected. Basic purposes must be kept in mind until fully attained. It has become customary for some schools and school systems to have weeks of special emphasis. They serve the purpose of stressing certain valuable ends. This becomes an absurd practice, however, when the

end of a special week brings a cessation of effort for the attainment of the desired goal. Unless the emphasis given during "health week" results in the perpetuation of the greatest effort throughout the year to secure the values there emphasized, this periodic stress is largely wasted.

It is important that the goals should be attainable and be formulated so concretely and specifically that progress is in evidence. It is essential that adequate checks be kept with a view to the discovery of whether the objective is reached and, if so, to what extent. An emphasis upon health should result in the formation of better health habits and an actual improvement in health.

The organization of an administrative staff and the routine of its work involves much of the psychology that we have learned. The superintendent must understand human nature in its various relationships in order to make the best selection of the teachers for their work. He must know the finer points of individual differences and of human relationships and contacts, and must apply them in the selection of teachers. An individual, in order to succeed in life, must have a significant task, a plan for working it out, and freedom of execution. The administrative officer of a school must feel that his task is significant, he must have a plan for the execution of his work, and he must be allowed freedom in order to execute it.

The school belongs to the public; it has their children to guide and to train. The administrative officer and the teachers of a school system are the servants of the public. The public should participate in the work of the school, but should leave the expert free to execute the work that should be done. Superintendents and teachers are better able to plan for the development of the children of the community than the majority of the parents. The relationship between the school and the public is exceedingly

important. The fundamental welfare of the children of a community should be the fundamental interest of every teacher. The teacher takes the place of the parents, and the good parent is interested in the welfare of his offspring. The public cannot be sympathetic with the work of the school unless that public knows something of the working of the school system. The transmission of information through the various mediums, such as newspapers and reports, is essential in order that the public may be informed of the progress of their institution. It is important that this information be accurate and interesting, and that it give a true picture of the school, its activities, purposes, needs, and place in the life of the community.

The psychology of teacher selection and promotion. Practical psychology can be used with great effect in the selection and promotion of the teaching staff. An analysis of teachers' qualifications, experience, education, intellectual ability, emotional balance, and social adjustment must be taken into consideration. The individual selecting his staff should be able to make an adequate inventory of all these abilities and adjustments. In the selection of a teacher, three important questions must be answered: first, Does the individual fit the position? second, Does the position fit the individual? and third, Can the teacher work in harmonious relationship with the social and physical environment and coöperate well with those who will work with her and guide her in her efforts? The psychology of school situations and of individual differences is exceedingly complex and difficult to analyze.

In analyzing the teacher it is essential to take into consideration the following: (1) the previous experience, training, and education and the possible hereditary tendencies of the individual; (2) his intellectual ability as manifested by educational achievement and advancement; (3) his habits

pertaining to his own control and adjustment with others; and (4) his ambition, outlook, and philosophy of life.

Experience alone is inadequate; in fact, any one factor taken by itself is not sufficient to determine a teacher's fitness for any position. To promote a teacher to an administrative position because of long teaching experience may prove an error. It is generally better to select one who has had practical training and experience in progressive adaptation to modern tendencies than one who has merely a college degree and some theory.

The task of selection and promotion is not so simple when the candidate has had no practical experience in the performance of the required duties. Supervised practice teaching or similar courses in the field of supervision and administration are one means of bridging the gap between theory and practice. When such courses are properly conducted, they serve as an excellent means of introducing the prospective educator to the practical problems of the field, as well as of providing a basis of judgment as to the probability of his success.

Many personal qualifications can be noted which are essential to success in teaching and which can be used as a basis for selection and promotion. The most important is mental and physical health. An essential of mental health is emotional stability, the ability to adapt one's self to the physical plant of the school, to the social conditions in the community, to the changing attitudes in children, and to the various situations which school administrators are constantly suggesting. The teacher who has harmonious adjustments with herself is better able to make harmonious adjustments with others. These factors are as important as intellectual ability and more important and valuable than academic training. Psychological factors of this kind should be used in the selection and promotion

of teachers. Thus far no satisfactory method of rating teachers has been devised. Not only is it difficult to single out all the specific factors which differentiate good and poor teachers; it is practically impossible to discover the particular combination of traits which make for the best equipment. It is possible for one to possess specific traits such as intelligence, energy, originality, and ambition, which when taken by themselves are good, but when taken together unfit the individual for the specific position. The psychology of adjustment and integration must be considered in the selection and promotion of a teacher.

Psychological factors in curriculum construction. One of the important functions of the administrative and teaching staff of any school system is the formation of the curricula of their school. A discussion of the psychological factors involved in curriculum construction should not come amiss.

The building of a curriculum is a complex problem. How this curriculum is built will largely be determined by the aims of life, the philosophy, and point of view of those who are building it. How we think about ourselves and what we think is important will largely determine what we shall expect of children. In the early periods of recorded history the Spartan aim was physical development, while the Athenian aim was intellectual development. These two aims led to entirely different content, methods, and procedures in the education of youth. The philosophy of life and the ideals of one group will lead to certain types of reaction, while the philosophy and ideals of the other will result in activity of an entirely different type and in a different direction.

The ideals of yesterday are not the ideals of today, and the ideals of today will not be the ideals of a century hence. Ideals and philosophies are changing from age to age, from century to century, and from year to year. This change is

inherent in all progressive, changing civilizations. The process of education is a continuous one. We are in a constant state of adjusting; we must learn to adjust ourselves to the changing ideas and ideals which come as a result of the ever-changing life purposes and environment of the world about us.

The following questions must be considered by those formulating a curriculum and the means of administering it in any school system: (1) What kind of boys and girls do you have in your school? (2) What kind of men and women do you wish these boys and girls to become? (3) What kind of school do you have? (4) What kind of school are you going to be satisfied with? (5) What kind of school do you think you should be satisfied with? (6) What kind of school curriculum can you arrange and satisfactorily administer? (7) Have teachers a clear-cut idea of what these boys and girls should become? (8) Are the teachers of the school prepared to say what instruction the children should have at the particular levels of their physical, mental, and emotional development? (9) Are teachers willing to assume the responsibility of predicting what children should become? What criteria are used to determine what children should become? (10) How skilled are we in prediction? (11) How shall we rear and educate children so that they will do what is expected or predicted of them? (12) Does the nature of the child, the subject matter, the method, have anything to do with curriculum construction? (13) How can we build a curriculum for our school that can be adjusted to the needs of life and will carry on after the child has left the school? (14) Is the curriculum you build going to be for the school alone, for the immediate present, or for the future welfare of the child after he leaves school?

There are three main parts to the building of a cur-

riculum: (1) the child; this includes his nature, his intellectual capacity, his environment, and his emotional balance; (2) the subject matter, which is the stimulus for activity and experiences out of which the child's mind grows and develops; (3) the method or procedure of bringing about the desirable activities which will result in proper relationships.

A knowledge of the nature, the intellectual capacity, and the emotional balance of the child must be taken into consideration in the building of any curriculum. The questions, "What takes place in a child when he learns?" and "How does it take place?" form an important part of the knowledge of teaching. It is just as important for the teacher to know how learning takes place as it is to know the content of the subject she teaches. The teacher should know what subject matter is necessary to stimulate those types of activity and experience which will help the child grow. The ultimate goal of any curriculum consists in desirable reactions on the part of the children who have been exposed to the subject matter of this curriculum. Since the subject matter is the stimulus to intellectual activity, the teacher must know something about the working of the sensory end organs, the changes that take place in the nervous system, the process of memory and recall, the working of the mind in the interpretation of the sensory stimulation; she must know how these sensations get their meaning; she must understand the workings of the imagination and how they are affected by memory images. No curriculum can be constructed for the good of any child that does not take into consideration the mental process of thinking of children. It must be understood that out of the thinking comes action. The problem is how to build a curriculum which will stimulate thinking and intellectual development on the part of the growing child. In many cases the school

curriculum is organized so as to require only the memory of materials.

A curriculum should be built so that the psychological processes will function to the best advantage for teacher and child. In order that the child may learn, certain psychological states must be induced. One of these is called the state of readiness on the part of the child, or rather the state of readiness on the part of his nervous system to receive stimulation. The teacher also must be in a state of readiness to stimulate the child. It is just as much a part of curriculum construction to have the proper steps in the procedure of giving knowledge and stimulation to the child as it is to have the content of so many pages in the textbook. There must be mental adjustment to the particular situation in hand. The content of the curriculum which furnishes the stimulus for either physical or mental action must be of such a nature as to bring about a mind set, or attitude, that will cause a child to act. It must be borne in mind that the child studying arithmetic or any other subject acquires more than a mere knowledge of the subject. He acquires an attitude that will to a large degree determine his future success in that subject and may be the most valuable by-product of his education.

Curriculum construction is a matter of evaluation. The subject matter taught in the school should be of a kind that will function in the life of the individual and also in his social relationships throughout life. It must provide at the same time for culture and for utility. From this we can think of the contents of the curriculum as the necessary stimulus to the psychology of learning.

The administrators and teachers of the schools must realize the fact that the curriculum must be built as a continuous one. Education is a continuous process, with no dividing lines such as those we set up in the schools

in the form of grades. There are no gaps in the process; there is one continuous road over which we travel, and this road runs the full length of human life.

In the building of a curriculum there must be taken into consideration the necessity of activity and participation. Psychology teaches that learning takes place only during activity or as a consequence of it. If this is true, then much of our present-day curriculum is wasted. The child learns very little, if anything, by merely listening. Participation is necessary. The curriculum must be so organized that it will be possible for the child to engage in the activities adjusted to his level of doing and of thinking, with an effort to reach a higher plane of thinking and acting. This stimulation to activity must be inherent in any curriculum construction. In the curriculum provision must be made whereby the teacher can, through the tools which we call the subject matter, direct the activities of children. Only the skillful teacher can do this. She must be a master of the subject matter, a master of the technique or method, and must have a very keen knowledge of the mental life and development of the child. It matters very little about the detailed part of a curriculum if the teacher has been given some freedom to work and if she understands how to stimulate activity. Her personality should stimulate a drive and an urge in the growing child.

The curriculum should be so constructed as to provide the possibility of satisfaction in the performance of the tasks required by the curriculum. No child learns much when he is repeating a lesson that is annoying to him and which does not challenge his power. When an act is satisfying there is a desire to repeat it. This brings into effect the law of exercise. In cases of this kind, drill should be provided and would have value. It is drill with attention and pleasure that counts; all else is waste. All children

should be happy in learning, for we know that normal, happy children learn. No one learns during a period of emotional excitement or stage fright. We cannot scare children into a knowledge of any subject. The question of thinking also must enter into the minds of those who are constructing a curriculum. How far shall we need to change our present curriculum to provide for good thinking and an opportunity to do constructive thinking?

Sources of the curriculum are found in the experiences of present-day life in which it is necessary and desirable to engage, together with the result of the experiences of the race in carrying on these activities. The contents of the curriculum should be so organized that it will promote the activities that make the child better because of the activity. The child should leave the school each day better than he entered. If this is not true, then something has gone wrong and the child is the loser.

We should modify our school organization so that it will better enable children to travel at their own gait, either at an accelerated speed or at a slower pace, according to their health, strength, and mental ability. The psychological factor of individual differences should be considered. We have talked at length about individual differences in the courses in psychology and educational psychology, but too little has been done by school administrators or by teachers to recognize individual differences and to put this knowledge of psychology into actual practice. The administration of the school should provide for the alteration of its organization of the curriculum so as to permit the young to have access to a wider range of interests and to pursue greatly different lines of study and activity. There must be a fundamental readjustment of the forces now employed by the schools to secure the most effective use of possible opportunities.

When we speak of education in general we mean a process by means of which the community or social group transmits its acquired powers and aims to the growing generation, with a view to securing its own continued existence and growth. The curriculum should be so organized that it will enable the child to develop to the limit of his capabilities as an individual and also as a member of his social group.

The work of the school should become more and more flexible. Differences, instead of uniformity, should be the aim of each teacher. The child will advance not with his class but according to his health, strength, ability, and willingness. He will not necessarily be equally good in all his subjects, because of differences in interest, but he will develop most in the subjects which he and his teachers think he is most in need of for his own growth and development.

The ideal of the complete personal development requires that every impediment be removed from the life of the child and that he be not hindered by extraneous forces. The curriculum should be organized to this end. Guidance, advice, suggestion, and freedom should be at his disposal whenever he feels the need for them.

The schools and their curricula should be so arranged that each individual child may develop his abilities and may share in the appreciation and enjoyment of the best values of social relationship.

Psychology in social relationships. Psychology is in an early stage of development. It deals primarily with the personality in its social setting and with the way in which it is affected by other persons and in turn affects them. Two very important conditions must be taken into consideration when we study social reactions. These we may call the environment and the individual. The individual develops through the influence of other personalities and

their work. Man cannot live unto himself alone, and if it were not for the contacts with the external environment, with other personalities, his thinking would not be what it is, nor would he develop to such a degree as he would in such relationships.

The environment in which an individual lives contributes the stimulus for the further alteration of his own environment. In actual living, the environment and the individual as two influences are constantly affecting each other. As a result of the social-personal influence of person on person, social norms are constantly being established and altered. This we see in the case of fashions and public opinion. The interrelationship between persons has brought about the development of ethical and moral codes. Moral codes have been worked out by groups of people as a result of crises, conflicts between man and man, or conflicts within the individual. When a group or individual has found a solution for these conflicts the next step usually is an attempt to project the solution upon a larger group. This is the way that the power of the old customs has been modified and diverted in its direction. It is because of these older conventions, ideals, and ideas that the modern reformer meets difficulties in attempting to project his theories and programs upon his group. Human nature does not change suddenly. Change for the better or for the worse is a slow process. The psychologist has much to offer in the matter of social reform if he could only organize his materials and stimulate activities in the right direction. Since social reform is a slow process, the teacher must understand the psychology of social reform and gradually inculcate the ideas into the thinking of the children. This is where guidance becomes effective. The teacher must first consider the individual as a developing, changing person in a developing, changing environment. The psycho-biological

nature of the individual must be examined in terms of behavior mechanism, structure, and variability. From the moment of birth, the individual has his physiological mechanism directed toward the condition of the environment in which he lives. The child's earliest environment is colored by social influences, by the effect of those about him, by the material conditions surrounding him. It is out of the interplay of the individual and his environment that personality is developed. What the child becomes will depend to a large degree upon the group contacts he makes.

The school is an important factor in social reform. Social reform cannot take place without taking into consideration the environment of the children and the various attributes and conditions of their organism. The emotions, feelings, and intellect must be taken into consideration. The motives of conduct come as a result of the drive stimulated by the feelings and emotions. The intellect has to do mostly with rational processes and conscious adjustment. The imagery, ideas, and attitudes reflect largely the conditioning process in adjusting to personal, social, and cultural factors in one's experiences. The imagery, ideals, and attitudes of the individual predetermine, to a large degree, how the person will respond to his future personal, social, and cultural stimulation. Psychology teaches how this mechanism works and how the conditioning and the integration of responses may take place. It tells us how the content of ideas and attitudes may be accumulated from experiences.

Psychology must make its contribution to the problem of the organization of the entire school system. It must make its contribution to the development of teachers' relationships with the pupil and the public; it must make its contribution in a field of social reform in such a way that people may live better, be better, and transmit to future

generations better conditions than exist at present. This can only be done when school administrators and teachers can see human life in all its relationships, can see each individual child as a total personality. Progress comes as a result of intelligent coöperation and direction of human activities.

QUESTIONS

1. Analyze the good and bad features of permanent tenure of teachers from a psychological point of view.

2. Discuss the psychology of teacher observation in the classroom. Under what conditions may a fairly accurate rating of teachers be made by this method?

3. In what ways may academic intelligence be a handicap to the success of a teacher in a particular situation? Granted that this is so, what suggestions would you make regarding the improvement of schools so that it should not be true?

4. Discuss the nature and type of school reports which should be made to the public, keeping psychological principles in mind.

5. Give illustrations from your experience which reveal failures to apply psychological principles in promoting some new project in the school.

6. Why is learning more than the studying of lessons or the making of assignments?

7. What psychological knowledge can we apply in the selection of teachers?

8. Rank in the order of importance the questions to be considered in the formulating of a curriculum.

9. How may the emotions be dealt with in curriculum construction?

10. List the sources from which a curriculum may be built.

11. Explain how social relationships may be a matter of psychology.

12. List five ways in which psychology may make its contribution to the problems of education.

REFERENCES

- ALMACK, J. C., and LANG, A. R. Problems of the Teaching Profession. Houghton Mifflin Company, Boston, 1925.
- BARR, A. S. Characteristic Differences in Good and Poor Teachers. Public School Publishing Company, Bloomington, 1929.
- BOBBIT, F. The Curriculum. Houghton Mifflin Company, Boston, 1918.
- FOLSOM, J. K. Social Psychology. Harper & Brothers, New York, 1931.
- HIGGINSON, G. D. Fields of Psychology. Henry Holt and Company, New York, 1931.
- LEWIS, E. E. Personnel Problems of the Teaching Staff. The Century Co., New York, 1925.
- YOUNG, K. Social Psychology. F. S. Crofts & Co., New York, 1930.
- YOUNG, K. Source Book for Social Psychology. F. S. Crofts & Co., New York, 1927.
- WHITNEY, F. L. The Growth of Teachers in Service. The Century Co., New York, 1927.
- WILLIAMS, L. A. The Making of High-School Curricula. Ginn and Company, Boston, 1928.
- National Education Association, Division of Research, "The Principal as Supervisor," Vol. VII, No. 5 (November, 1929), Washington, D.C.
- National Education Association, Division of Research, "Ethics in the Teaching Profession," Vol. IX, No. 1 (January, 1931), Washington, D.C.

GLOSSARY

Acromegaly: Enlargement of bones of hands, feet, and face, due to overfunctioning of pituitary gland.

Adjustment: The systematic combination of integration and coördination.

Adrenin: A substance secreted by the two adrenal glands.

Afferent: A term applied to nerve fibers that lead to the brain and cord centers. Sensory fibers are afferent.

Amentia: Mental deficiency.

Amnesia: Loss of memory.

Anæsthesia: Loss of sensation.

Anatomical age: An age denoting level attained in growth of body structure.

Aphasia: Loss of ability to speak.

Aphonia: Loss of voice.

Apperception: Interpretation of sense experiences in the light of previous experience and the mind set.

Apraxia: Loss of the power to perform previously learned habitual acts, due to an organic injury to the brain.

A.Q.: Accomplishment quotient; $\frac{EA}{MA}$ or $\frac{EQ}{IQ}$.

Association: The process by which one situation elicits a response.

The bond, or connection, between the stimulus and response is sometimes called an association. Ideas may be associated because they have been associated in the past, or because they have some relation.

Associative shifting: Any response of which a learner is capable may become associated with any situation to which he is sensitive.

Astigmatism: A blurring of vision due to defective curvature of lens or cornea.

Ataxia: Loss of the power to coördinate movement, leading to awkwardness with hands or legs.

Attitude: A settled manner of acting and thinking because of habitual feeling or opinion. "Manner in which an individual receives experiences, so far as this is determined by the deep, lasting traces left in the nervous structure by frequent repetition of experiences of the same fundamental type." (Warren)

Autocoid: Secretion of ductless glands.

Automatic activity: Activity carried on with little or no attention to the activity itself.

Autonomic: Applied to that division of the nervous system which regulates visceral and endocrinal responses or activities.

Axone: A process of a nerve cell which conducts the impulse away from the cell body.

Bar graph: A column graph in which the variable quantities are represented by bars.

Behavior: The responses of an organism.

Binet-Simon test: An individual test of general intelligence devised by Binet and Simon.

Bond: Connection between situation and response (S-O-R).

Capacity: A name given to the highest type of inherited S-O-R bonds, which are very indefinite, complex, variable, and modifiable.

Centile: A point on the scale indicating a unit per-cent division of the total group.

Central tendency: A measure which shows the trend of a distribution of data and which represents the whole data.

Cerebellum: Literally the "little brain." A large ganglionic mass located posteriorly beneath the cerebrum. It has to do with the coördination of movement and with equilibrium.

Cerebral: Pertaining to the cerebrum of the brain.

Cerebrospinal: Pertaining to the brain and spinal cord.

Cerebrum: Refers to hemispheres of the largest brain mass.

Chalones: Autocoids that inhibit activity.

Character: Sum total of personal reaction systems and tendencies.

Chromosomes: Minute germinal units containing determiners every one of which acts as a determinant of some hereditary character.

Compensation: "Exaggerated manifestation of one character-trend as a defense against its opposite which is painfully repressed; relief in substitute symptom formation." (Jackson)

Complex: Organic habit of ideation; a term denoting repressed emotion and its associated elements.

Conditioned reflex: A reflex in which the inherited nervous connections have been altered by use.

Conditioning: Broadly speaking, a synonym for "learning."

Configuration: A coexistence of phenomena in which each member "carries every other," and in which each member possesses its peculiarity only by virtue of, and in connection with, all others.

Conflict: Struggle between frustrated and conscious trends or between instinct and social practices.

Consciousness: The sum total of conscious activities at any moment.
Consummatory reaction: The end reaction that directly brings satisfaction.

Convergence: Combining, or uniting, of nerve impulses.

Convolution: A fold between two or more fissures or clefts in brain tissue.

Coördination: The systematic distribution of motor impulses.

Correlation: Mutual, or reciprocal, relationship between two capacities or functions.

Cortex: Literally "bark," that is, outer covering, or gray matter, of the brain.

Cranial nerve: A peripheral nerve which leaves the brain.

Creative imagination: Productive imagination which is unhampered, unrestricted, "fancy-free."

Cretinism: A disease in childhood due to lack of secretion of the thyroid gland.

Decile: A point on the scale below which 10 per cent of the group fall.

Deduction: "A process of thinking in which the learner starts with laws, principles, or hypotheses and applies them to individual cases; or tests their validity; or discovers new individual facts by means of them." (Bolton)

Defense mechanisms: These have "as their purpose, among other things, defending the individual from a knowledge of his own shortcomings or deficiencies. They are all efforts, ineffectual efforts and therefore forms of compromise and compensation, to escape the adequate, straightforward and necessary way of dealing with reality if it is to be effectually handled." (White)

Delirium: An acute mental disorder, occurring in connection with systemic poisoning, general infections, head injuries, and other conditions. It is characterized by confusion, disorientation, excitement, and sometimes by hallucinations.

Delusion: A falsified fixed idea or belief without foundation in evidence, in conflict with evidence, and recognized as obviously false by persons of normal judgment.

Dementia præcox: A general term for a form of chronic psychosis known as schizophrenia, which usually appears in adolescence. It is a maladaptation involving a fundamental splitting between the emotional, the thought, and the motor processes.

Dendrites: Processes carrying nerve impulses to cell body of neurone.

Diffusion: The scattering of nerve impulses into different channels.

Drill: "Repeating an activity, not for the sake of understanding, but to increase one's facility or skill, or to fix associations in the memory." (Freeman)

Echolalia: Automatic repetition of speech.

Echopraxia: Automatic repetition of observed movements by a patient.

Educational psychology: The science of human behavior in relation to educational situations.

Effect, law of: Satisfaction strengthens a bond; annoyance weakens it.

Efferent: Leading away from the center, as the nerve impulses that go to the muscles.

Environment: Sum total of all conditions that actively influence the development of any organism from without.

Epilepsy: A disease characterized by periodic, sudden seizures in which the patient loses consciousness.

Euphoria: A general feeling of well-being often experienced by mental patients.

Evolution: In biology, the theory that all higher forms have originated from lower forms of life by a process of gradual adaptive change.

Exophthalmic goiter: A disease which involves a hyper-functioning of the thyroid gland and which is characterized by enlargement of this gland and protrusion of the eyeballs.

Exteroceptors: Sense organs distributed over the surface of the body.

Feeling: A simple pleasurable or painful aspect of any mental state or process.

Flexibilitas cerea (Waxy flexibility): A symptom arising from a volitional disorder of the reactions, characterized by a tendency on the part of the patient to retain indefinitely the position in which he may be placed.

Formal or mental discipline: The doctrine that mental ability, however gained, is applicable in all kinds of situations regardless of conditions.

Free attention: Attention given with no "feeling" of effort.

Frequency column: A column showing the number of scores tabulated in each class interval.

Frequency polygon: A line graph in which the distribution of frequency is shown.

Frequency surface: Any distribution of measures shown graphically.

Fugue: A state during which the patient for a certain period of time apparently acts in a conscious way, perhaps traveling, buying food, and in general comporting himself in a natural manner, though afterward he has no awareness of what happened during this time. An insane desire to run away.

Ganglion: Group of nerve cells usually manifesting itself by a slight swelling in the path of a nerve or by a protuberance in the brain.

Generalization: An idea which is the outgrowth of a mode of re-

- sponse which is found applicable to a whole class of objects. It is usually embodied in the statement of a general principle.
- Genes:** Hypothetical trait determiners located in chromosomes.
- Genetic:** Pertaining to the origin or beginning of phenomena.
- Gestalt theory:** That a psychic structure is more than "the sum of its parts," is not "summative," and is composed of interdependent members, each of which derives its nature from its place in the whole.
- Gland:** A cell, tissue, or organ which separates materials from the blood or lymph and therewith produces certain chemical compounds in solution, called secretions, these secretions being discharged either directly on the surface of the body, or through ducts to the outside, or into the blood or lymph.
- Habits:** Tendencies to respond which are created wholly or in part by experience, practice, or training.
- Heredity:** Law of transmission and reproduction of ancestral traits in descendants, or organic resemblances based on descent.
- Histogram:** "A bar or column graph showing the measures within a step spread out over columns whose bases are the size of the step-interval and whose heights are the frequencies of the steps." (Ralston and Gage)
- Hormone:** The term "hormone" means any substance normally produced in the cells of some part of the body and carried by the blood to distant parts, which it affects for the good of the organism as a whole.
- Hypermetropia:** Farsightedness.
- Hypochondria:** An undue preoccupation with one's own health.
- Ideal:** A generalized notion or general concept used as a plan or standard of action; the recognition and appreciation of the practical worth of this plan or standard; and a tendency (habit) to accept and obey the plan or standard, to act it out in conduct.
- Identical elements:** Refers to elements, learnings, or fragments of learnings or their physiological correlates common or similar to two or more situations.
- Imagination:** The mental process by which experience is extended beyond the immediately present time and space.
- Induction:** A process of thinking in which the learner discovers laws, or generalizations, from individual data.
- Inhibition:** Partial or complete checking or prevention of any activity, whether movement or thought.
- Inhibition, retroactive:** When another form of mental activity, or another piece of "learning by heart," immediately follows the work of memorizing, it tends to obliterate the memory trace. The effect

of the second piece of work in undoing the results of the first is termed "retroactive inhibition."

Innate: Implanted by nature; inborn.

Innervate: To supply with nervous stimulation.

Insanity: A legal term denoting a disorder of conduct or impaired judgment shown by a failure to adjust the self to surroundings.

Instinct: A term denoting unlearned reactions and tendencies, of greater complexity than reflexes, common to all normal members of the species.

Integration: "The systematic assembling and marshalling of all the impulses which reach the brain in a given moment." (Warren)

Intelligence: General ability, or the capacity to make adequate mental and social adaptations to new problems or situations.

Intelligence quotient (I.Q.): The ratio of one's mental age to his actual chronological age multiplied by 100. (I.Q., or intelligence quotient, is the quotient found by multiplying the mental age by 100 and dividing by the chronological age.) European authorities usually do not multiply by 100, but express the quotient as .95 or 1.20.

Interest: "An attitude of mind toward a course of action or an object in which one is impelled from within to carry on the action, or to give attention to, examine, handle, approach or in other ways act toward the object; and in which the satisfaction of this impulse gives pleasure." (Freeman)

Interoceptors: Sense organs lying along the alimentary canal.

Introspection: Subjective observation.

Introvert: A person whose interests, thoughts, and activities are largely self-centered.

Kinaesthesia: The peculiar form of awareness of our muscular movements.

Law of exercise: The likelihood that a given response will be made to a given situation is in proportion to the frequency of its connection with the situation.

Law of readiness: "(1) When a conduction unit is ready to conduct, conduction by it is satisfying, nothing being done to alter its action; (2) for a conduction unit ready to conduct, not to conduct is annoying, and provokes whatever response nature provides in connection with that particular annoying lack; (3) when a conduction unit unready for conduction is forced to conduct, conduction by it is annoying." (Thorndike)

Maturation: Inner maturing or "ripening" of the organism.

Mean: Average obtained by dividing sum of measures by number of cases.

Median: That point on the scale of distribution on each side of which one half of the measures fall.

Memory: The reinstatement of an old experience, together with the knowledge that it has been experienced before.

Mendelism: The theory of heredity established by Mendel, which associates peculiar characteristics in the offspring with specific determinants in the germ plasm, and enables one, from the characteristics of the parents, to calculate beforehand the ratio in which a characteristic will be present or lacking in the offspring.

Mental age: The mental level measured in years and corresponding to the average mentality of children at the year designated. Age measured by the level of intelligence as distinct from real chronological age. By it we mean that a child's performance on the tests is equal to the average performance of a fair sampling of children of the same chronological age.

Mental set: The learner's set, attitude, adjustment, or determining tendency.

Metabolism: "The sum of the processes concerned in the building up of protoplasm and its destruction incidental to the manifestation of vital phenomena." (Webster)

Mind: The sum total of mental processes in a lifetime.

Mode: The score that occurs most frequently in a distribution.

Mores: Group habits or folkways.

Moron: A grade of feeble-mindedness little below normality.

Motor coördination: A group of simple movements which combine simultaneously or successively to produce some definite result.

Multiple response: Denotes that many possible responses can be given to a situation.

Myelin sheath: A covering or insulation of axone fibers.

Myopia: Nearsightedness.

Myxœdema: A disorder in physical and mental development due to defect of the thyroid glands.

Nervous arc: A series of nerve units leading either directly or indirectly from a sense organ to a muscle.

Neurasthenia: A chronic state of nervous exhaustion.

Neurokyme: The nerve impulse.

Neurone: The microscopic unit of the nervous system consisting of a nerve cell with its prolongations, the dendrites and the axone.

Neurosis: A nervous disorder.

Neurotic: Predisposed to nervous disorders.

Norm: The average achievement of a large group used as a standard.

Nystagmus: Rapid oscillation of the eyeballs.

Obliviscence: Forgetfulness.

Ogive: A special way of representing a cumulative frequency distribution.

Original nature: Action traits and tendencies that function without previous learning.

Overlearning: Learning beyond the threshold.

Paranoia: A mental disorder characterized by systematic delusions.

Parathyroids: Small bodies embedded in the thyroid lobes.

Partial activity: One or another element of an original situation is prepotent in effecting the response.

Percentile curve: A curve made on graph paper that enables an individual to calculate percentiles.

Percentile rank: A pupil's rank determined by the percentage of the group which fall below him.

Perception: A sensation which has acquired a meaning through its combination with other sensations.

Personality: All those traits which have a social and personal significance.

Phobia: A persistent, unreasoning fear of some object or situation.

Pituitrin: Active element of the secretion of posterior lobe of pituitary body.

Plasticity: Denotes sensitivity and modifiability of nerve structure of behavior patterns.

Plateau: A place in the practice curve more or less on a level, representing lack of measurable progress.

Play: "An activity which, from the point of view of the observer, meets no need except that of the development; and from the point of view of the one who plays, is carried on entirely for its own sake and not for the sake of the results." (Freeman)

Preparatory reactions: Reactions only "mediately of benefit to the organism, their value lying in the fact that they lead to, and make possible, a consummatory reaction." (Woodworth)

Probable error (P.E.): A measure of reliability indicating one-half the range within which the chances are even that any computed measure may vary as a representative of the group sampled.

Prognostic Test: A test designed to predict ability to learn a subject or to perform an activity.

Projection: Blaming another for one's own shortcomings, making another responsible for one's acts, or imagining accusations.

Proprioceptors: Sense organs between surface of the body and the internal surface.

Psychiatry: A branch of medicine relating to mental disease.

Psychology: The science of behavior.

Psychoneurosis: A nervous disorder involving special mental symptoms.

Puberty: The age of sexual maturity.

Purpose: Mind-set-to-an-end. Plan and motive occurring together.

Quartile deviation: The semi-interquartile range which expresses the degree of dispersion or variability.

Quintile: A point on the scale below which 20 per cent of the group fall.

Range: Difference between highest and lowest scores.

Readiness: When a bond is ready to act, to act gives satisfaction; not to act gives annoyance.

Reasoning: Reflective thinking.

Receptors: The sense organs.

Reflex: The simplest inherited S-O-R bond. The mechanical response of a muscle or gland to a definite sensory stimulus. A definite response to a definite stimulus, due to an inherited arrangement of nerve paths.

Reflex arc: The nervous path of a reflex action from the sensory area of stimulation to the center and out again to the muscle or gland.

Reflex circuit: "A reflex arc plus the return path leading from the muscle back to the central part of the circuit." (Freeman)

Reliability: The accuracy with which a measure portrays that which it purports to measure.

Scale: "A scale is a series of perfectly defined amounts, the difference between any two of them being also defined so that a series varying by steps of equal difference can readily be selected." (Nifenecker)

Sensation: A simple experience which is produced by the stimulation of one of the sense organs.

Sense organs: Specialized nerve endings or structures in the body which are sensitive to various kinds of stimuli.

Sensorimotor activity: The adaptation of a movement to a stimulus.

Series: In statistics, a grouping of measures of the variable by steps or classes.

Sibling: A brother or sister who is not a twin.

Skewness: Lack of symmetry of a distribution, with central tendency of data at one side of the base scale rather than in the middle.

Skill: A complex of simple coordinated habits.

Social inheritance: The customs, mores, and social institutions evolved by the race.

Standard deviation (S.D., or sigma): The square root of the mean of the square of the deviations of each score from the mean of the scores.

Statistics: Normative science which deals with collection, classification, and tabulation of numerical data as a basis for the explanation, description, and comparison of phenomena.

Stimulus: Any physical, chemical, or neural occurrence which may affect an individual's sense organs and arouse within him a sensation, idea, or movement.

Strabismus: Cross-eyedness.

Sublimation: The process of utilizing primitive instinctive impulses in intellectual and æsthetic pursuits or social and religious causes.

Tethelin: Active element of the secretion of the anterior pituitary lobe.

Thalamus: A mass of gray matter in the inner brain which serves mainly as a sensory relay.

Thinking: A process of observing, comparing, deliberating possibilities, coming to a decision, and testing the conclusion.

Thymus: A gland located in the upper part of the chest, functioning primarily during childhood.

Thyroxin: Active principle of the secretion of the thyroid gland.

Tics: Muscular twitchings.

Tonus: Partial and persistent contraction of muscles.

Toxin: A poison, usually of metabolic or bacterial origin.

Unit: In measurement, a unit is a certain distance on the scale in terms of which quantities are expressed.

Variability: The degree of scatter of measures about a central tendency.

Variable: A quantity under which the given conditions may assume different values.

Viscera: Organs inside chest and abdomen.

Voluntary attention: Attention given with feeling of effort and conditioned by a sense of duty or ambition.

Will: The sum of the conditions of choice — inherited and acquired.

Work: Activity, whether satisfying or annoying, which is performed primarily to attain some desired end.

Zygote: Cell formed by the union of sperm and egg.

INDEX

- Ability, factors in, 33 f.
- Abstract thinking, 256 f.
- Acceleration in school, 155
- Accomplishment Quotient, 303 f.
- Accuracy and speed, 199
- Achievement tests. *See* Educational measurements, Tests
- Activity, and habits, 145 f.; and learning, 132, 187, 191 f., 214; in perception training, 223, 225; in personality development, 405, 408; in school curricula, 462; needed for development, 90 f.; types of expressive, 192 f.
- Adaptation, 28; essential to learning, 133
- Administration of schools, and psychology, 451 f.
- Adolescence, changes in, 90, 100
- Adrenal glands, 70; in emotion, 120
- Adrenin, function of, 70, 85
- Adult and child compared, 137, 267 f.
- Adviser, characteristics of, 358 f., 390
- Æsthetics, training in, 125
- Age and plasticity, 27
- Age-grade table, 154
- Agraphia, 235
- Alexander, H. B., on schooling and intelligence, 49 f.
- Analysis in guidance, 351
- Analytic judgment, 261 f.
- Anatomical age, 93
- Animal and man compared, 63, 65, 132
- Animal psychology, 13
- Animals, learning in, 134 f.
- Aphasia, 234
- Approval, social, in habit formation, 145
- Apraxia, 234
- Aptitude, methods of determining vocational, 362
- Army Alpha Test, 49, 278
- Army Beta Test, 51, 278
- Association, and attention, 167; and learning, 131, 133, 138 f., 147; and sensation, 237; conditions of, 231; defects of, 235, 239; defined, 229; errors in, 238; in memory, 240 f.; physiological basis of, 229
- Association fibers, 76
- Associations, method of making, 230; testing of, 235
- Associative learning, 229 f.
- Associative shifting, 27
- Attention, and association, 239; conditions of, 170 f.; effect of, 168; forms of, 165; in learning, 164; in perception, 220 f.; specificity of, 169
- Attitudes, and attention, 172; and character, 381, 391; in habit formation, 145; tests of moral, 386
- Attributes, statistics of, 315
- Auditory defects, 63
- Autacoids, 67
- Autonomic nervous system, 75 f.; comparison with cerebrospinal, 77, 84, 106; divisions of, 84
- Averages, 328 f.
- Avocational guidance, 363, 365
- Axones, 74
- Ayres, L. P., index of state school systems, 49
- Bagley, W. C., experiment on transfer of neatness, 179; on schooling and intelligence, 498
- Baldwin, B. T., 12; on mental and physical development, 95
- Behavior, accuracy of prediction of, 55; and character, 380; as index of personality, 401 f.; at birth, 25 f.; biological bases of, 55 f.; changes in, 55; de-

- viations, 415; dynamics of, 102 f.; emotional, 119; human determinants of, 7; infant, 26 f.; instinctive, 19; kinds of, 3, 6; motivating, 111 f.; problems, 393; tests of, 385 f.
- Binet, 273
- Binet and Simon test, 277
- Biological bases of behavior, 55 f.
- Blends, instinctive, 23; of sensation, 207
- Boys and girls compared as to rate of growth, 92
- Brain, described, 77 f.; functioning as a whole, 139; importance of, 73
- Brightness and dullness, 25, 32; compared, 236
- Brooks, F. D., mental and physical development, 96
- Burke, Barbara, on measurement of heredity and environment, 48
- Burnham, W. H., on essentials of mental hygiene, 443; on integration of personality, 412
- Burt, C., on heredity and environment, 48 f.
- Cannon, W. B., on emotion, 108; on physiology of emotion, 119
- Capacity and instincts, 31
- Carr, H. A., 65; on play, 190
- Catatonia, 438
- Cattell, J. M., 273; on environment as determiner of genius, 41
- Cells, function of, 397
- Central tendency, 328 f.
- Cerebellum, 78, 79, 81
- Cerebrospinal system, 77 f.; comparison of, with autonomic, 106
- Cerebrum, 78 f.
- Chalones, 67
- Character and environment, 47
- Character and habit, 379
- Character, formation by memorizing rules, 380
- Character, meaning of, 372; measurement of, 385 f.; native factors in, 377 f.; psychology of, 372 f.
- Character education, feasibility of, 375; importance of, 373
- Cheating in tests, 302
- Child, as basis of curriculum, 360; growth of, 89; need for understanding of, 415; psychology in study of development of, 21; understanding of, in guidance, 359
- Child and adult, compared as to perception, 220 f.; compared as to size of parts, 89; compared as to memory, 245; compared in thinking, 267 f.
- Child and animal compared, 63
- Child, C. M., on heredity and environment, 52 f.; on integration of personality, 411
- Childhood, changes in, 100; critical period in habit formation, 148; emotional control in, 127; formation of personality in, 400, 403 f.
- Choice, in character formation, 381; in personality development, 409
- Chorea, 435 f.
- Chromosomes, 36
- Class intervals, 322
- Class sectioning on basis of physical maturity, 96
- Classification, of needs in guidance, 351; of pupils by mental tests, 283; of pupils by new-type tests, 305; of pupils by standard tests, 307
- Classified tables, 316 f.
- Coefficient of correlation, 335
- Coleridge on training in thinking, 270
- Collings, E., on motive, 105; on behavior with a drive, 110
- Compact classified tables, 316, 318
- Comparative psychology, 13
- Compensation, 432, 434
- Concepts in perception, 219
- Concrete thinking, 254 f.
- Conditioned reflexes, 27 f.
- Conditioned response, orders of, 29
- Conditioning and learning, 28
- Conditioning, process of, 145 f.
- Conditioning, technique of, 29
- Configuration, 58
- Connection-forming, 138 f.
- Conquering-hero tendency, 427
- Consciousness, defined, 6
- Consistency in personality, 410

- Contiguity, law of, 231
 Control, of associations, 231 f.; of perceptions, 223 f.; of sensations, 224
 Controlled association tests, 236
 Convergence, 72
 Cooperation, need for, in school relations, 451; of home in guidance, 369; of pupils in testing, 310, 358
 Coördination, in infancy, 100; motor, 213
 Corrective work, in guidance, 353
 Correlation, statistical measure of, 335 f.
 Correlation table, 339
 Cortex of brain, 79 f., 82; as organ of response, 64
 Courtis, S. A., 289
 Cox, C. M., studies of genius, 46
 Cramming, 246
 Creative effort, 194
 Creative tendencies, in human beings, 63
 Cretinism, 68, 398
 Crile, G. W., on physiology of emotion, 119
 Criminal tendencies, inborn, 378
 Criminality and glandular instability, 399 f.
 Curriculum, character courses in, 389
 Curriculum construction, psychological factors in, 458 f.
 Curve, of learning, 155 f.; of error, 157; problem-solving, 157; time, 155 f.; work, 156
 Darrow, C., on Jukes family, 43
 Davenport, C. B., on genetic factors in development, 399
 De Candolle, on effect of environment, 40
 Deductive and inductive methods, 201
 Deductive method in thinking, 257 f., 263
 Defects, mental, 416 f.; of association, 235; of parathyroid gland, 69; of personality, 397 f., 414 f.; of pineal gland, 71; of senses, 63, 209 f.; of speech, and nervous disorders, 435; of thyroid gland, 68
 Deliberative activity, 192
 Delusions, in paranoia, 439
 Dementia, defined, 436; form of, 436 f.; præcox, 437 f.; symptoms of, 437
 Dendrites, 74
 Development, defined, 89; emotional, 13; factors in, 90 f.; mental, 13; physiological, 94; relation of mental and physical, 95 f.; stages of, 97
 Deviation, measures of, 332 f.
 Dewey, J., on interest, 109; on thinking, 265, 268
 Diagnosis, by mental tests, 285; in guidance, 360
 Diagnostic and remedial work as guidance, 367
 Diagnostic chart, 295
 Diagnostic educational test, 294
 Diagnostic grouping of pupils, 308
 Differences in human beings, 16.
See also Individual differences
 Diffusion, 72
 Disjunction, reasoning by, 264
 Dissociation, 429 f.; and character, 381
 Disuse, law of, in ideals, 383
 Drill, distribution of, 160, 176 f.; function of, 159; in learning, 148 f.
 Drives. *See* Motive
 Dugdale, study of heredity in the Jukes family, 42
 Dynamic psychology, 102
 Dynamics of behavior, 102 f.
 Ebbinghaus, 33, 152, 273
 Economy, in memorizing, 246 f.; of instruction as stimulus to testing, 291
 Education, aim of, 3, 412; aims of, in curricula, 458; and crime, 392; and instincts, 24; as guidance, 347; defined, 5; function of, 13, 446; importance of character, 373; of attention, 173; value of mental tests in, 283 f.; vocational, early steps in, 361
 Educational age, 303
 Educational agencies in character formation, 376

- Educational guidance, and mental tests, 284; defined, 348; methods in, 366 f.
- Educational measurements, 289-314
- Educational methods, efficiency of, 195
- Educational psychology, aim of, 55; defined, 3, 7; function of, 5, 7; methods in getting data, 8; sources of data, 8; subject matter and methods of, 3-15; topics in, 7; use of statistics in, 315; value of, 4, 8, 14, 56
- Educational Quotient, 303
- Educational tests, cautions in use of, 306 f.; development of, 289; difficulty of constructing, 293; need for, 290; relation of, to intelligence tests, 289
- Effect, in attention, 166; law of, in learning, 159 f.; principle of, 146
- Efficiency in methods, 195
- Emotion, and expression, 193, 194; and instinct, 117; and maturation, 22; and memory, 248; as compensation, 108 f.; function of, 108; physiology of, 118 f.
- Emotional development, lack of knowledge of, 126
- Emotional instability and character, 377
- Emotionality, 425; definition of general, 122
- Emotions, and adrenin, 70, 85; and character, 391; and feelings, 114 f.; and internal reactions, 85; and thyroid gland, 69; control of, 123 f.; education of, 126 f.; in adjustment, 425; in learning, 162; modification of, 123; physiological changes in, 119 f.; primary, 117 f.; repression of, 126; types of, 116
- Emphasis in association, 232
- Endocrine deficiency, treatment of, 398
- Endocrine glands, 67 f.; origin of, 72
- Endocrinology, 67
- Endowment, native, 16
- Environment, and character, 47; and genius, 40; and heredity, 36 f., 52, 151 f.; and the individual, 465; and training in character, 375; as factor in producing scientists, 40 f.; control of, in mental disease, 420; influence of, on mental life, 46; value and limitations of, 32
- Epilepsy, 441
- Error curve, 157
- Essay examinations, 297
- Estabrook, G. H., criticism of Dugdale on Jukes family, 43
- Eugenics, 152
- Euthenics, 152
- Exercise, and attention, 175; principle of, 145
- Experience as source of percepts, 221, 223, 226
- Experimental method explained, 10
- Experiments in transfer, 179 f.
- Expression, and emotion, 194; and learning, 191 f., 202; value of, in education, 192
- Extroceptors, 60
- Extroversion and introversion, 427 f.
- Eye, functioning of, 59
- Facilitation, 82
- Faculty psychology, 178
- Failure, as factor in inferiority feeling, 432 f.; experience of pupils in, 358
- Fear, as factor in inferiority feeling, 433; as primary emotion, 117; characteristics of, 123; means of treating, 123 f.
- Feeling, and learning, 26; characteristics of, 114, 115
- Feeling of inferiority, causes and treatment of, 431 f.
- Feelings, and emotions, 114 f.; classification of, 115 f.; theories of, 114 f.
- Feeling-tone, 208; in perception, 220
- Flexibility, in school work, 464
- Forgetting, and understanding, 245; rate of, 161; value of, 161, 230 f.
- Forgiveness, place of, in character education, 390 f.
- Form-board, 280

- Formal discipline. *See* Transfer of training
- Forms, equivalent, of tests, 302
- Forms, illustrations of test, 311 f.; of mental tests, 279; of new-type tests, 298 f.
- Foster children, study of, 47
- Free association tests, 235
- Freeman, F. N., on development, 96; study of foster children, 47; study of twins, 48
- Frequency, graphs, 324 f.; histogram, 324 f.; polygon, 325 f.; tables, 316 f.
- Froebel, 361
- Galton, F., 273; intelligence of, as a child, 46; studies by, on heredity, 39; study of heredity of twins, 45
- Gametes, 36
- Ganglia, sympathetic, 75, 77, 84
- Gates, A. I., on mental and physical development, 95, 96
- General factor in ability, 33
- Generalization, and sensation, 211; theory of, 184 f.
- Genes, 36
- Genetic psychology, 12, 13
- Genius, and environment, 40; and heredity, 39; heredity of, 45 f.
- Germ cells, 36
- Gesell, A., 12, 26; on maturation, 20 f.
- Gestalt psychology, 102; applied to guidance, 356; theory of transfer, 185 f.
- Glands, 67 f.; types of, 67; value of, 64
- Glandular instability, and criminality, 399 f.
- Goddard, H. H., study of heredity in the Kallikak family, 43
- Goddard revision of Binet, 278
- Grade score, use of, in tests, 304
- Graphic forms as aid to learning, 111, 199
- Group test, 278 f.
- Grouped frequency table, 323
- Grouping, of measures, 322 f.; of pupils in educational guidance, 367; of pupils in remedial work, 353 f.
- Growth, and development, 88 f.; defined, 88; factors in, 90 f.; maturity in, 91; of child, 89; rate of, 91, 92; rate of prenatal, 98
- Guidance, as creative work, 358; defined, 346; difficulties in, 354; educational, and mental tests, 284; goals in, 355; in character education, 387; need for, 349; program, 360; psychology of, 347-369; steps in, 350; types of, 348; vocational, and mental tests, 384
- Habit, and association, 230; and character, 379, 382; and conditioning, 147; defined, 141; early development of, 100; elimination of, 149; importance of, in childhood, 148; permanence of, 143; physical basis of, 141 f.; relation to native tendencies, 142, 144; systems of, in personality development, 396; value of, 141
- Habit formation, 140 f.; process of, 27, 28
- Hall, G. Stanley, 12
- Hate, described, 124
- Health, a factor in growth, 91
- Hearing defects, extent of, 210
- Hebephrenia, 437
- Heredity, a factor in attention, 173; a factor in growth, 90; and character, 375; and environment, 36 f., 52, 91, 151 f.; and genius, 39; laws of, 36; of mental disease, 419 f.; studies of, 42 f. *See also* Nature and nurture
- Herrick, C. J., 62; on explanation of emotions, 118 f.; theory of motive, 107
- Herring revision, of Binet, 277
- Histogram of frequency, 324 f.
- Hollingsworth, H. L., 117
- Hormones, 67
- Hyperthyroidism, 68, 69
- Hypothesis, 12; in reasoning, 264
- Hysteria, 442
- Ideals and character, 382
- Ideas, relationship of, in thinking, 252 f.

- Identical elements, theory of, in transfer, 183 f.
- Identical twins, maturation in, 21
- Identification, as adjustment, 428
- Imagination, and play, 191; in concrete thinking, 256
- Imitation, 226; in hysteria, 442; in learning, 201; in mental disease, 434
- Imitative activity, 193
- Impulsive activity, 193
- Inattention, 239
- Incentives, characteristics of good, 111 f.; in learning, 159; need for artificial, 110
- Index of brightness, 282
- Individual differences, and curriculum, 463; causes of, 151; in association, 237; in capacity, 25; in learning, 31-32, 200; in motivation, 112; in personality, 409 f.; in plasticity, 27; in work of guidance, 356; of pupils, 150; range of, 152 f.
- Individual tests, 277 f.
- Induction, 255, 263
- Inductive method, and deductive, 201; in thinking, 257
- Infancy, behavior during, 26 f.; characteristics of, 99; importance of experiences in, 434
- Inferiority, feeling of, 431 f.
- Inheritance, biological, 13; social, 13
- Inhibition, 83, 194; and freedom, 405, 406; and learning, 161 f.; by attention, 165
- Initiative, and restraint, 405; of child, in guidance work, 356 f.; of learner, 198; in test procedure, 297
- Insight in learning, 136-138, 225
- Instability, emotional, 425; glandular and criminality, 399 f.; nervous, 436
- Instinctive behavior, 19; modification of, 24 f.
- Instinctive blends, 23 f.
- Instinctive tendencies, 19; and character, 378; use of term, 24
- Instincts, 18 f.; and capacity, 31; and emotion, 117; and maturation, 20; basic aspects of, 19 f.; classification of, 23; control of, 30; criteria of, 22; defined, 18-20, 276; in education, 24; modifiability of, 20; number of, 22; relation of habits to, 142, 144; theory of, 18; use of term, 18, 24; value of, 20, 24
- Instruction, delay of, in primary grades, 22
- Integration, 64, 83; and personality development, 396 f.
- Intelligence, 31 f.; and character, 377; and memory, 249; and motor ability, 213; and vocational guidance, 285; classification of, 287; defined, 32; effect of environment on, 39; effect of environment on, of foster children, 47; growth of, 285; measurement of, 273 f.; theories of, 33
- Intelligence Quotient, 278; as basis of class sectioning, 283, 287
- Intelligence tests, 275 f.; effect of schooling on results of, 49 f.; in vocational guidance, 363
- Intensity of sensations, factors controlling, 206
- Interest, and character, 388; and guidance, 359, 364; as a drive, 109; guidance in, 368; in learning, 166 f., 199; in personality development, 407 f.; in school work, 110 f.
- Interference in association, 239-240
- Interoceptors, 61
- Interpolation in finding median, 329
- Introspection defined, 9
- Introversion, and extroversion, 427 f.
- I.Q., constancy of, 39, 286
- James-Lange theory of emotions, 118
- James, William, 22; experiment in memory training, 179; on emotions, 118; on habit, 146; on learning, 161
- Jennings, H. S., 37; on animal learning, 134; on environment, 46

- Judd, C. H., 65; theory of generalization, 184 f.
- Judgment, accuracy of, 262, 265; and memory, 249; in relational thinking, 259, 261 f.; moral, 383 f., 389; of personality, 401; types of relationships in, 261 f.
- Jukes family, as example of heredity, 42-43
- Juvenile delinquency, 374
- Kallikak family as example of heredity, 43 f.
- Kempf, E. J., explanation of motive, 106
- Kent-Rosanoff Association Test, 235
- Kuhlman revision of Binet, 278
- Laboratory work as perceptual thinking, 255
- Lange, J., on inheritance in criminals, 38
- Language, importance of, 65 f.
- Language response, 65
- Lashley, K., on synaptic theory, 72
- Law, attitudes toward, 391
- Laws, derivation of, 12
- Learned behavior based on instincts and reflexes, 25
- Learner, the basis of method, 196
- Learning, and attention, 164; and character, 379; and conditioning, 28; and drill, 176; and expression, 191 f.; and sensation, 204 f.; and thinking, 251 f.; as modification of native behavior, 25; associative, 229 f.; basis of personality development, 406; by observation, 137; capacity for, 31; characteristics of, 134 f.; curve, 155 f.; defined, 26, 56 f., 131; development of, 27; guiding principles in, 159 f.; individual differences in, 150; initial speed in, 157; initiative in, 198; insight in, 136 f.; perceptual, 216 f.; plateaus, 158; process, 131 f.; relation of perception to, 218; results of, 57; sensorimotor, 214; simple and complex, 132, 200; through satisfaction, 29; trial and error, 133 f.; types of, 133 f.; upper limit of, 158; waste in, 4, 176, 195
- Lewy-Guinsberg. *See* Naccarati
- Linear classified tables, 316 f.
- Linkage of nerve tissue, 73
- Localization in brain, 79
- Localization of function in brain, 139
- Logic, 261
- Logical memory, 242, 249
- Logical method of teaching, 196 f.
- Maladjustment, causes of, 414
- Man, and animals compared, 65, 73; and animal learning compared, 136
- Manias, 441
- Manic depressive psychosis, 441
- Manual activities, early steps in, 361
- Manual training introduced, 361
- Marks, use of new-type tests in assigning, 305; variation of school, 290
- Maturation, and training, 21; defined, 20; factors affecting, 21, 22; hypothesis, 20 f.
- Maturation hypothesis, significance in education, 22
- Maturity, in growth, 91; mental, 286; ossification as index of, 96
- Maze learning, 135 f.
- Mean, as statistical average, 329 f.
- Meaning, and attention, 168; in activity, 193; in learning, 160, 216 f.
- Measurement, 14; educational, 239 f.; of character, 385 f.; of intelligence, 273 f.; of personality traits, 409
- Median as statistical average, 329
- Medulla of brain, 78, 81
- Meek, Lois, 12
- Memory, as a learning type, 136; association in, 240 f.; in children and adults, 245; in concrete thinking, 255; logical, 242; permanence of, 245; process involved in, 242 f.
- Mendel, laws of inheritance, 36
- Mental ability, classification of, 153

- Mental age, 277; as basis of class sectioning, 283; as basis of classification, 287
- Mental development, 13
- Mental disease, heredity and environment in, 419 f.; prevention of, 419 f.
- Mental disorders, prevalence and cause of, 416 f.
- Mental disturbances, types of, 422, 426
- Mental functions, improvement of, 178
- Mental health of teachers, 457
- Mental hygiene, 416; basic principles of, 443; need for knowledge of, 420; object of, 414; political aspects of, 418
- Mental set, as a condition of association, 233
- Mental tests, value of, in education, 283 f.
- Mental traits, individual differences in, 152 f.
- Metabolism, 67
- Methods, efficiency of educational, 195; in educational guidance, 366 f.; in statistics, 315 f.; in vocational guidance, 361 f.; laboratory, 218; of teaching, changes in, 3
- Meumann, E., 273
- Mind, definition of, 6
- Mind set, and habit formation, 146
- Minogue, on effect of environment on intelligence, 39
- Mode, as statistical average, 328
- Modifiability of nerve tissue, 72
- Mongolism, 398
- Mood, defined, 121
- Motivation, and tonicity, 66; defined, 103; in character formation, 382, 391; in personality development, 405; in pupil guidance, 357; in school work, 110 f.
- Motive, 103 f.; in learning process, 133
- Motives, classification of, 105
- Motor ability and intelligence, 213
- Motor behavior and sensation, 212
- Muller and Newman, study of environment of identical twins, 47
- Multifactor theory, 33
- Muscle tonus, 66
- Muscles, kinds of, 66; value of, 64
- Myelin sheath, 99
- Naccarati, on mental and physical development, 95
- National Society for the Study of Education, "Nature and Nurture," 27th Yearbook of, 47 f.
- Native behavior, 25; described, 26
- Native capacity, tests of, 275 f.
- Native equipment, 16; and intelligence, 32
- Native factors in character formation, 377
- Nature and nurture, 36 f.
- Needs for guidance, classification of, 351; record of, 351 f.
- Negative adaptation, 28
- Negro, schooling and intelligence of, 51
- Nerve cells, 76; growth and development in, 89
- Nerve impulse, 57, 205; diffusion and convergence, 72, 82; direction of, 74; permanence of results of, 143
- Nervous children, rules for treatment of, 444 f.
- Nervous instability, 436
- Nervous system, 73 f.; description of autonomic, 735; function of, 73, 77, 83
- Nervousness, cause of, 423 f.
- Neural circuit, 139
- Neural patterns, basis of learning, 132 f.; early development of, 99
- Neurokyme, 57
- Neurones, described, 73 f., 76; growth of, before birth, 98; kinds of, 74; number of, 74
- Neurotic constitution, 422 f.
- New-type tests in education, 295 f.
- Nonsense learning, 160
- Normal probability curve in scoring, 305; in testing reliability, 341
- Normality, maintenance of, 414
- Norms, development of, in educational tests, 293; of mental tests, 281; on new-type tests, 296; social, and the individual, 465; use of, as goals, 310
- Nutrition, a factor in growth, 90

- Objective method, 8
- Objectives in school work, need for, 453
- Observation, as scientific method, 8; in perception, 223, 225 f.; in scientific method, 11
- Ogive, 326
- Omnibus test, 294
- Ordinary place rank, 319
- Organism, as determiner of response, 102; whole of, involved in instincts, 23
- Organization, of mental tests, 279, 281; of tests in education, 296 f.
- Organs of response, 64 f.
- Orientation courses as guidance, 366
- Original nature, 16 f.
- Otis Self-Administering Tests of Mental Ability, 282
- Overlapping in grades, 155, 291
- Overlearning, 175, 246
- Paranoia, 439
- Paranoid form of dementia, 438
- Parathyroid glands, 69
- Paresis, general, 440
- Parker, S. C., on ordinary thinking, 266
- Pearson product-moment method of correlation, 336 f.
- Percentile curve, 326 f.
- Percentile rank, 32 f.; in test interpretation, 304
- Perception, 61 f., 208; and association, 140; and learning, 218 f.; control of, 223 f.; errors of, 216; formation of, 219 f.; order of, 218 f.; training in, 222
- Perceptual learning, 216 f.
- Perceptual thinking, 254 f.
- Performance tests, 280
- Perrin, F. A. C., on motive, 103
- Personal relations, psychology in, 451
- Personality, elements of, 400, 402 f.
- Personality adjustments, 414 f.
- Personality defects, 414 f.
- Personality development and integration, 396 f.
- Personality traits and character, 372
- Physical basis, of habits, 141 f.; of personality, 397, 402 f.
- Physical condition, and association, 234
- Physical diagnosis in guidance, 369
- Physical maturity, as basis of class sectioning, 96
- Physiological age, 93
- Physiological basis, of thought, 251; of motives, 105
- Physiology of emotion, 118-121
- Pihlflad, summary of Cattell's *American Men of Science*, 41
- Pineal gland, 71
- Pituitary body, 70 f.
- Pituitrin, 71
- Plasticity, defined, 27; individual differences in, 27; relation to capacity, 31
- Plateaus in learning, 158
- Play, a factor in learning, 187 f.; and character education, 388; and imagination, 191; and work compared, 189 f.; defined, 188; value of, in child development, 190
- Plexus, kinds of, 75
- Point scales, 277
- Pollock, H. M., on mental disease in rural and urban areas, 419; on prevention of mental disease, 421
- Polygon of frequency, 325 f.
- Prediction, by standard tests, 295; of behavior, accuracy of, 55
- Prenatal period, factors in, 98
- Preparation for perception, 224, 225
- Prevention of mental disease, 419 f.
- Preventive work, 353
- Prevocational guidance, 364
- Principle, defined, 12
- Probable error, 342
- Problem basis of thinking, 252
- Problem-solving, curve of, 157
- Product-moment method of correlation, 336 f.
- Prognostic tests, 282; in education, 295
- Progress, irregularity of learning, 157
- Proprioceptors, 60
- Pseudo-science, in vocational guidance, 361, 362

- Psychogenic epidemic, 434; tendency in hysteria, 442
- Psychological method in education, 196
- Psychological tests, types of, 274 f.
- Psychology, applications of, outside the school, 450; defined, 5; faculty, 178; function of, 7; in school relationships, 450 f.; of character, 372 f.; of guidance, 347 f.; relation to sociology, 7. *See* Educational psychology
- Public opinion and character education, 392
- Public relations, of school, 455
- Punishment, use of, 30, 390
- Purpose, as a drive, 109; in associative learning, 236
- Quartile deviation, 333
- Races, native intelligence of, 51
- Radosavljevich, P., 273
- Rank, ordinary place, 319; percentile, 320 f.
- Rank method of correlation, 335 f.
- Ranking of measures, 319 f.
- Report, in guidance, 359
- Rating, of teachers, 458; scales in character, 386
- Rationalization, as adjustment, 428
- Reactions, at birth, 99; conditioning of, 27; in establishing habits, 145, 146; internal relation to emotion, 85. *See* Glands
- Readiness, and attention, 174; laws of, 109; of muscles to act, 64
- Reading, complexity of, 58; evolution of method in, 197
- Reasoning, 251 f.; and character, 383 f.; testing of, in educational tests, 301
- Recall, and association, 240 f., 243; in perception, 220
- Recognition, 240, 243, 244
- Reconditioning, 29
- Reflex act, defined, 17; mechanics of, 17; modification of, 17
- Reflex arc, concept, 17; in learning, 140
- Reflexes, at birth, 99; chained, 19; conditioned, 27
- Reform, social, 465 f.
- Relational thinking, 258 f.
- Reliability, of educational tests, 293; in statistics, 341 f.
- Remedial work, 353
- Response, elimination of, 29; organs of, 64 f.; substitute, 28
- Rest, needed for development, 90-91
- Retardation in school, 154
- Retention, 242, 243
- Retrospection, 9
- Review of drill, 149, 161
- Rhythm, in learning, 162
- Rivalry, as incentive, 112
- Rosanoff, A. J., on heredity of mental defects, 419
- Rotch, on mental and physical development, 95
- Rote memory, 241
- St. Vitus Dance, 435
- Sandiford, P., summary of Thorndike on heredity, 45
- Satisfaction and learning, 29
- Scatter diagram, 340
- School, in social reform, 466
- School relationship, psychology in, 450 f.
- School responsibility for character education, 374
- School subjects, adaptability to testing, 293, 294; progress in, as basis of classification, 284; transfer value of, 180 f.
- Schools, need for prevention of maladjustments in, 421
- Science, as relational thinking, 260
- Scientific investigation, characteristics of, 11; need for statistics in, 315
- Scientific method, 8; in guidance, 360; qualifications for, 10; steps in, 11
- Scoring, need for training in, of tests, 309; of essay tests, 297; of recognition tests, 299; of standard tests, 281, 303 f.; of true-false tests, 300
- Selection by attention, 164
- Sensation, and association, 237; and learning, 204 f.; defined, 61; quality and intensity of, 205 f.
- Sensation blends, 207

- Sensations, control of, 224; due to cortical activity, 140; importance of, for learning, 210 f.
 Sense organs, 57 f.; at birth, 99; defects of, 63, 208 f., 211; function of, at birth, 26; kinds of, 60; origin of, 72; stimuli of, 62
 Sense perceptions, 208
 Senses, importance of, 61; training of, 210, 222
 Sensorimotor learning, 204, 212 f.
 Sensory areas of brain, 79
 Sentiment, 122
 Sentiments and character, 382
 Sex emotions, 116
 Sex glands, 71
 Short-circuit in habit formation, 141, 144
 Siblings compared with twins, 45
 Situations, changing nature of, 24
 Skepticism, 252
 Skills, motor, 213
 Social agencies and character education, 392
 Social development, 13
 Social drives, 106
 Social heritage, 7
 Social psychology, 12
 Social relationships, psychology in, 464
 Sociology, relation to psychology, 7
 "Sour-grapes tendency," 429
 Spearman, C., on two-factor theory of intelligence, 33
 Spearman rank method of correlation, 335 f.
 Special factors of ability, 33
 Specific mental tests for diagnosis, 285
 Specific psychology tests, 274
 Specificity of attention, 169
 Speculation, 252
 Speech abnormalities and nervous disorders, 435
 Speed and accuracy, 199
 Spinal cord, 58, 75
 Spontaneous activity, 192
 Standard achievement tests, 292
 Standard duration, 333
 Standardization defined, 280 f.
 Stanford-Binet Test, as a diagnostic test, 285
 Stanford revision of Binet, 278
 Statistical methods, 315-343
 Stern, W., 278
 Stimuli, and attention, 171; sense, 57, 59; substitute, 28
 Stout, G. F., 65
 Study, guidance in, 367
 Subjective factors of attention, 171
 Subjective judgment in test construction and use, 294
 Subjective method, 9
 Substitute response, 28
 Substitute stimulus, 28
 Substitution, of habits, 150; of instincts, 30
 Success, experience of, in guidance, 358
 Suffering-martyr tendency, 428
 Suggestibility, in dementia, 438; in perception, 221 f.
 Suggestion and character, 379
 Superintendent of schools, psychology of, 453
 Supervised study, 367
 Supervision, training for and attitude in, 452
 Syllogism, in thinking, 250
 Sympathetic ganglia, 75, 77, 84
 Sympathetic section of autonomic nervous system, 84
 Synapse, 74
 Synaptic theory, 72, 138
 Synthesis by attention, 168
 Syphilis, as cause of paresis, 440
 Systemic senses, 61
 Talents and guidance, 363
 Teacher, as guide, 3, 347, 359; need of, for understanding children, 415; psychology of selection and promotion, 456 f.; use of tests in evaluating efficiency of, 306
 Teaching, methods of. *See* Methods
 Temperament, defined, 121; types of, 121
 Terman, L. M., 273, 278; on constancy of the I.Q., 286; study of gifted children, 45
 Test batteries in education, 293 f.
 Testing, of association, 235; special technique of, 303 f.
 Tests, and measurements, in educational psychology, 14; apti-

- tude, 362; educational need for, 290; intelligence, in vocational guidance, 363; of intelligence, 34; of moral behavior, 385 f.; results of educational, 291 f.; types of, 292 f.; use of, in guidance, 369
- Tethelin, 71
- Thalamus, 78, 81
- Theory, defined, 12; vs. practice on learning, 147
- Thinking, and learning, 251 f.; early stages of, 252; levels of, 354 f.
- Thorndike, E. L., 22, 273, 289; experiment on transfer of training, 179, 180 f.; on economy of learning, 247; on explanation of drives, 109; on multifactor theory of intelligence, 33; study of heredity of twins, 45; theory of identical elements, 183 f.
- Thurstone, L. L., on dynamic point of view, 102
- Thymus gland, 71
- Thyroid gland, 67 f.; in emotion, 120 f.
- Thyroxin, 68; value of, 69
- Time curve, 155-156
- Tolman, E. C., on drives, 104
- Tones, muscle, 66
- Tonicity, 66
- Toxins, prenatal influence of, 98
- Traditional methods in education, 196
- Training, and character, 380; and maturation, 21; in thinking, 266, 268, 269 f.; in use of tests, 309 f.; limitations of, 21; needed for testing, 278; of teachers on basis of test results, 308
- Traits, origin of, 36
- Transfer of training, 177 f.; amount of, 180 f.; defined, 178; experiments in, 179; practical aspects of, 186 f.; theories of, 183 f.
- Treatment and prevention of mental disease, 419 f.
- Trial-and-error learning, 183 f.; and character, 380; and observation, 226
- Tropisms, and behavior, 17
- True-false test form, 300
- Twins, differences in, 151; maturation of identical, 21; nature and nurture in identical, 37 f.; studies in heredity in, 45
- Two-factor theory, 33
- Understanding, sympathetic, in school work, 451 f.
- Unifactor theory, 35
- Unstandardized tests in education, 295 f.
- Validity, of educational tests, 293; of mental tests, 277, 280
- Variables, statistics of, 315
- Visiting teacher, as guidance counselor, 369
- Visual defects, 63; extent of, 209
- Vocational aptitude, 362
- Vocational guidance, and mental tests, 284; defined, 348; methods in, 361 f.
- Volition and character, 382
- Voluntary attention, 165
- Ward, L., on environment and social status, 41
- Watson, J. B., 12, 26; on primary emotions, 117
- Weight-height tables, use of, 93
- Willard, on schooling and intelligence, 49
- Wilson, M. O., on behavior with a drive, 110; on motives, 105
- Woodrow, H., on development, 95; on theory of intelligence, 33, 34
- Woods, F. A., study of royalty, 42
- Woodworth, R. S., 18; experiment on judgment training, 179; on motive, 104 f.; on primary emotions, 117
- Work, and character education, 387; and play compared, 189 f.; curve of, 155 f.; factor in personality development, 408
- Wundt, W., 65, 273
- Yerkes-Foster Revision of Binet, 277
- Zygote, 36

